9-2320-266-34/990

TM 9-2320-266-34

TECHNICAL MANUAL

DIRECT AND GENERAL SUPPORT
MAINTENANCE MANUAL

TRUCK, CARGO; 1-1/4 TON, 4X4

M880 (2320-00-579-8942)
M881 (2320-00-579-8943)
M882 (2320-00-579-8957)
M883 (2320-00-579-8959)
M884 (2320-00-579-8985)
M885 (2320-00-579-8989)

TRUCK, CARGO; 1-1/4 TON, 4X2

M890 (2320-00-579-8991)
M891 (2320-00-579-9046)
M892 (2320-00-579-9052)

TRUCK, AMBULANCE; 1-1/4 TON, 4X4

M886 (2310-00-579-9078)

TRUCK, AMBULANCE; 1-1/4 TON, 4X2

M893 (2310-00-125-5679)

TRUCK, TELEPHONE MAINTENANCE; 1¼-TON, 4X4
M888 (NSN 2320-01-044-0333)

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HEADQUARTERS, DEPARTMENT OF THE ARMY

JANUARY 1976

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CHANGE
NO. 7

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *1 APR 86*

Direct Support and General Support Maintenance Manual

TRUCK CARGO: 1 1/4 TON, 4X4
M880 (NSN 2320-00-579-8942), M881 (NSN 2320-00-579-8943)
M882 (NSN 2320-00-579-8957), M883 (NSN 2320-00-579-8959)
M884 (NSN 2320-00-579-8985), M885 (NSN 2320-00-579-8989)
TRUCK, CARGO: 1 1/4 TON, 4X2
M890 (NSN 2320-00-579-8991), M891 (NSN 2320-00-579-9046)
M892 (NSN 2320-00-579-9052)
TRUCK, AMBULANCE: 1 1/4 TON, 4X4
M886 (NSN 2310-00-579-9078)
TRUCK, AMBULANCE: 1 1/4 TON, 4X2
M893 (NSN 2310-00-125-5679)
TRUCK, TELEPHONE MAINTENANCE: 1 1/4 TON, 4X4
M888 (NSN 2320-01-044-0333)

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1-2	1-2	11-2	11-2
1-2.1/1-2.2 (blank)	1-2.1/1-2.2 (blank)	11-6	11-6
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5-1	5-1	22-2	22-2
9-3/9-4 (blank)	9-3/9-4 (blank)	Index 1	Index 1
10-3	10-3	Index 5/Index 6 (blank)	Index 5/Index 6 (blank)
10-4	10-4	DA Form 2028-2	DA Form 2028-2
		none	10-11/10-12(blank)
		12-5/12-6	12-5/12-6

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To be distributed in accordance with DA Form 12-38, Direct and General Support Maintenance requirements for Truck, 1 1/4-ton, Cargo: 1 1/4-ton, 4x4, M715, Ambulance: 725 and Maintenance: 726.

CHANGE
NO. 6

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, 19 May 1982

Direct Support and General Support Maintenance Manual

TRUCK CARGO: 1¼ TON, 4X4
M880 (NSN 2320-00-579-8942), M881 (NSN 2320-00-579-8943)
M882 (NSN 2320-00-579-8957), M883 (NSN 2320-00-579-8959)
M884 (NSN 2320-00-579-8985), M885 (NSN 2320-00-579-8989)

TRUCK, CARGO: 1¼ TON, 4X2
M890 (NSN 2320-00-579-8991), M891 (NSN 2320-00-579-9046)
M892 (NSN 2320-00-579-9052)

TRUCK, AMBULANCE: 1¼ TON, 4X4
M886 (NSN 2310-00-579-9078)

TRUCK, AMBULANCE: 1¼ TON, 4X2
M893 (NSN 2310-00-125-5679)

TRUCK, TELEPHONE MAINTENANCE: 1¼ TON, 4X4
M888 (NSN 2320-01-044-0333)

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i and ii	i and ii	None	10-6.5 and 10-6.6
1-1 and 1-2	1-1 and 1-2	10-7 and 10-8	10-7 and 10-8
1-3 and 1-4	1-3 and 1-4	None	10-9 through 10-11/(10-12 blank)
None	1-4.1/(1-4.2 blank)	11-1 through 11-4	11-1 through 11-4
1-5 and 1-6	1-5 and 1-6	11-17 and 11-18	11-17 and 11-18
4-19 and 4-20	4-19 and 4-20	17-1 and 17-2	17-1 and 17-2
4-23 and 4-24	4-23 and 4-24	17-9/(17-10 blank)	17-9/(17-10 blank)
4-25 and 4-26	4-25 and 4-26	19-3 and 19-4	19-3 and 19-4
5-1 and 5-2	5-1 and 5-2	None	25-1 through 25-8
7-9 and 7-10	7-9 and 7-10	None	26-1/(26-2 blank)
10-1 and 10-2	10-1 and 10-2	A-1 and A-2	A-1 and A-2
None	10-2.1/(10-2.2 blank)	Index 1 through 4	Index 1 through 4
10-3 through 10-6	10-3 through 10-6		
10-6.3/(10-6.4 blank)	10-6.3 and 10-6.4		

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CHANGE
NO. 5

HEADQUARTERS
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WASHINGTON, D C *20 September 1980*

Direct Support and General Support Maintenance Manual

TRUCK CARGO: 1¼ TON, 4X4
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M882 (NSN 2320-00-579-8957), M883 (NSN 2320-00-579-8959)
M884 (NSN 2320-00-579-8958), M885 (NSN 2320-00-579-8989)
TRUCK, CARGO: 1¼ TON, 4X2
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M892 (NSN 2320-00-579-9052)
TRUCK, AMBULANCE: 1¼ TON, 4X4
M886 (NSN 2310-00-579-9078)
TRUCK, AMBULANCE: 1¼ TON, 4X2
M893 (NSN 2310-00-579-5679)
TRUCK, TELEPHONE MAINTENANCE: 1¼ TON, 4X4
M888 (NSN 2320-01-044-0333)

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Index 1/Index 2	Index 1 thru Index 2.1

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CHANGE
No. 4

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Direct Support and General Support Maintenance Manual

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M882 (NSN 2320-00-579-8957), M883 (NSN 2320-00-579-8959)
M884 (NSN 2320-00-579-8958), M885 (NSN 2320-00-579-8989)

TRUCK, CARGO: 1¼-TON, 4X2
M890 (NSN 2320-00-579-8991), M891 (NSN 2320-00-579-9046)
M892 (NSN 2320-00-579-9052)

TRUCK, AMBULANCE: 1¼-TON, 4X4
M886 (NSN 2310-00-579-9078)

TRUCK, AMBULANCE: 1¼-TON, 4X2
M893 (NSN 2310-00-579-5679)

TRUCK, TELEPHONE MAINTENANCE; 1¼-TON, 4X4
M888 (NSN 2320-01-044-0333)

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M882 (NSN 2320-00-579-8957), M883 (NSN 2320-00-579-8959)
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M892 (NSN 2320-00-579-9052)
TRUCK, AMBULANCE: 1¼-TON, 4X4
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TRUCK, AMBULANCE: 1¼-TON, 4X2
M893 (NSN 2310-00-579-5679)
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Remove pages	*Insert pages*
i and ii	i and ii
1-1 and 1-2	1-1 and 1-2
None	1-2.1 and 1-2.2 (blank)
1-7 and 1-8	1-7 and 1-8
8-3 and 8-4	8-3 and 8-4 (blank)

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M882 (NSN 2320-00-579-8957), M883 (NSN 2320-00-579-8959)
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M892 (NSN 2320-00-579-9052)
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i and ii	i and ii
1-1 and 1-2	1-1 and 1-2
1-5 through 1-8	1-5 through 1-8
3-1 through 3-4	3-1 through 3-4
3-7 and 3-8	3-7 and 3-8
4-1 and 4-2	4-1 and 4-2
None	4-2.1/(4-2.2 Blank)
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None	4-24.1/(4-24.2 Blank)
6-3 and 6-4	6-3 and 6-4
None	6-4.1/(6-4.2 Blank)
6-5/(6-6 Blank)	6-5 and 6-6
7-5 and 7-6	7-5 and 7-6
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None	10-6.1 through 10-6.3/(10-6.4 Blank)
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11-11 and 11-12	11-11 and 11-12
13-3/(13-4 Blank)	13-3/(13-4 Blank)
14-5 and 14-6	14-5 and 14-6
18-3 and 18-4	18-3 and 18-4
18-9 and 18-10	18-9 and 18-10

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23-1/(23-2 Blank)	23-1 and 23-2
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None	24-1/(24-2 Blank)
A-1 and A-2	A-1 and A-2
Index 1 and Index 2	Index 1 and Index 2

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4-19 and 4-20	4-19 and 4-20
None	4-20.1/4-20.2(blank)
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6-5/6-6(blank)	6-5/6-6(blank)
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7-9 through 7-11/7-12(blank)	7-9 through 7-11/7-12(blank)
8-1 and 8-2	8-1 and 8-2
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11-3 and 11-4	11-3 and 11-4
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12-7/12-8(blank)	12-7/12-8(blank)
17-1 and 17-2	17-1 and 17-2

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None	23-1/23-2(blank)
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Index 1 through Index 5/index 6 (blank)	Index 1 through Index 5/Index 6(blank)
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Distribution:

To be distributed in accordance with DA Form 12-38, direct and general support maintenance requirements for truck, 1¼-ton, 4x4, M715, ambulance M725 and maintenance M726.

WARNING

CARBON MONOXIDE POISONING CAN BE DEADLY

Carbon monoxide is a colorless, odorless, poisonous gas, which, when breathed, deprives the body of oxygen and causes suffocation. Exposure to air contaminated with carbon monoxide produces symptoms of headache, dizziness, loss of muscular control, apparent drowsiness, or coma. Permanent brain damage or death can result from severe exposure.

Carbon monoxide occurs in the exhaust fumes of fuel-burning heaters and internal-combustion engines and becomes dangerously concentrated under conditions of inadequate ventilation. The following precautions must be observed to insure the safety of personnel whenever the personnel heater and main or auxiliary engine of any vehicle is operated for maintenance purposes or tactical use.

1. DO NOT operate the heater or engine of the vehicle in an enclosed area unless it is ADEQUATELY VENTILATED.
2. DO NOT idle the engine for long periods without maintaining ADEQUATE VENTILATION in personnel compartments.
3. DO NOT drive any vehicle with inspection plates, cover plates, or engine compartment doors removed unless necessary for maintenance purposes.
4. BE ALERT at all times during vehicle operation for exhaust odors and exposure symptoms. If either are present, IMMEDIATELY VENTILATE personnel compartments. If symptoms persist, remove affected personnel from the vehicle and treat as follows: Expose to fresh air; keep warm; DO NOT PERMIT PHYSICAL EXERCISE; if necessary, administer artificial respiration.

THE BEST DEFENSE AGAINST CARBON MONOXIDE POISONING IS ADEQUATE VENTILATION.

TECHNICAL MANUAL
TM 9-2320-266-34

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C. *5 January 1976*

DIRECT AND GENERAL SUPPORT MAINTENANCE MANUAL
TRUCK, CARGO; 1-1/4 TON, 4X4, M880 SERIES
TRUCK, CARGO; 1-1/4 TON, 4X2, M890 SERIES
TRUCK, AMBULANCE; 1-1/4 TON, 4X4, M886
TRUCK, AMBULANCE; 1-1/4 TON, 4X2, M893
TRUCK, TELEPHONE MAINTENANCE; 1-1/4 TON, 4X4, M888

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PART ONE

GENERAL INFORMATION

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope.

This manual contains instructions for personnel at the Direct Support and General Support maintenance levels for the maintenance of M880-series trucks.

1-2. Use of This Technical Manual.

This technical manual (TM) is organized in three parts. Part one contains general information which is applicable to all users. Part two contains instructions for repairs that can be accomplished on the truck. Part three contains instructions for repairing components after they are removed from the truck. Specifications are contained in tables within the applicable chapter.

1-3. Maintenance Forms and Records.

DA Pam 738-750 (The Army Maintenance Management System) explains maintenance forms, records, and procedures required for use with these trucks.

Use DA Form 2404 (Equipment Inspection and Maintenance Worksheet) to record any faults that you discover before, during, and after operation unless you can fix them yourself. You do not need to record faults that you fix yourself unless they involve replacing parts. When you replace a part tell organizational maintenance so they can enter the repair work in their record system.

1-3.1. Equipment Improvement Report and Maintenance Digest (EIR MD).

The quartely Equipment Improvement Report and Maintenance Digest, TB 43-0001-39 series, contains valuable field information on the equipment covered in this manual. The information in the TB 43-0001-39 series is compiled from some of the Equipment Improvement Reports that you prepared on the vehicle(s) covered in this manual. Many of these articles result from comments, suggestions, and improvement recommendations that you submitted to the EIR program. The TB 43-0001-39 series contains information on equipment improvements, minor alterations, proposed Modification Work Orders (MWO's), warranties (if applicable), actions taken on some of your DA Form 2028's (Recommended Changes to Publications), and advance information on proposed changes that may affect this manual. The information will help you in doing your job better and will help in keeping you advised of the latest changes to this manual. Also refer to DA Pam 310, Consolidated Index of Army Publications and Blank Forms, and appendix A, of this manual.

1-4. Destruction of Army Materiel to Prevent Enemy Use.

Refer to TM 750-244-6.

1-5. Administrative Storage.

Refer to TM 740-90-1.

1-6. Reporting Errors and Recommending Improvements.

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: US Army Tank-Automotive Command, ATTN: AMSTA-MB, Warren, MI 48397-5000. A reply will be furnished to you.

1-7. Warranty Information.

The M880-series trucks are covered by a manufacturer's warranty for 12 months or 12,000 miles, whichever comes first. For detailed information about the warranty and the processing of claims, refer to TB 9-2300-295-15/14.

Section II. DESCRIPTION AND DATA

1-8. Description.

a. The 1-1/4 ton trucks shown in figures 1-1 through 1-4.2 are commercial vehicles suitable for use on all types of roads and highways in all types of weather. In addition, the 4X4 models are designed for cross-country use and will ford hard-bottom streams to a depth of 16 inches. All vehicles have an automatic transmission with three forward and one reverse speeds. All trucks use a 318 cubic-inch displacement engine which operates on regular, leaded gasoline. The braking system uses hydraulically-activated, power-assisted, front disc and rear drum service brakes. The maintenance paragraphs of this manual contain detailed descriptions of the trucks' components.

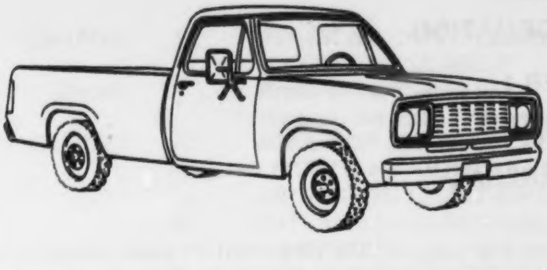
TA180888

Figure 1-1. M880/M890 Cargo Truck, Right Front View.

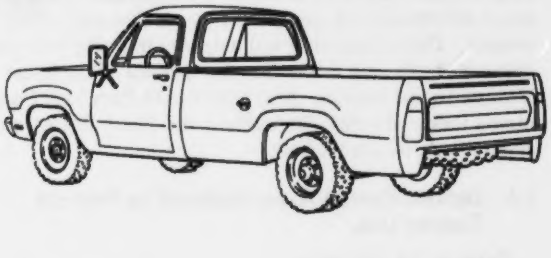
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Figure 1-2. M880/M890 Cargo Truck, Left Rear View.

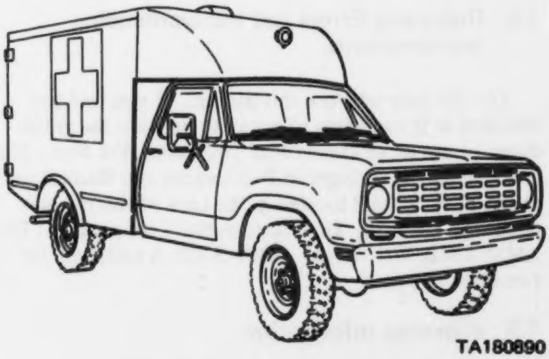
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Figure 1-3. M886/M893 Ambulance, Right Front View.

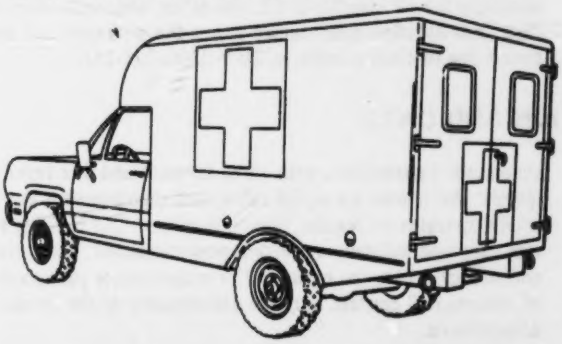
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Figure 1-4. M886/M893 Ambulance, Left Rear View.

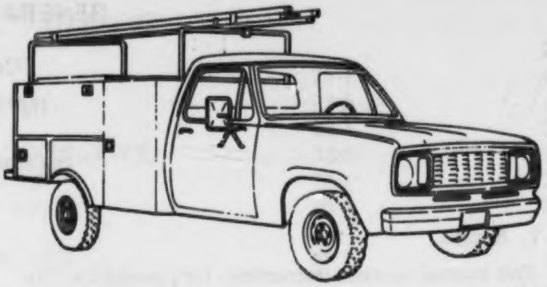
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Figure 1-4.1. M888 Telephone Maintenance Truck, Right Front View.

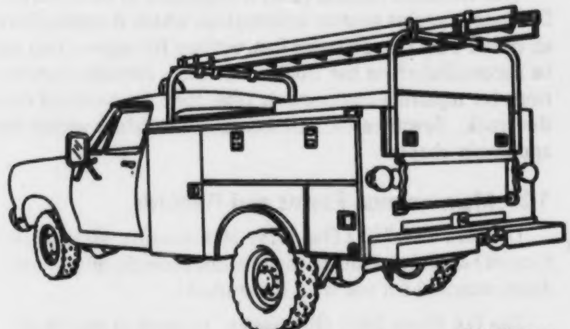
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Figure 1-4.2 M888 Telephone Maintenance Truck, Left Rear View.

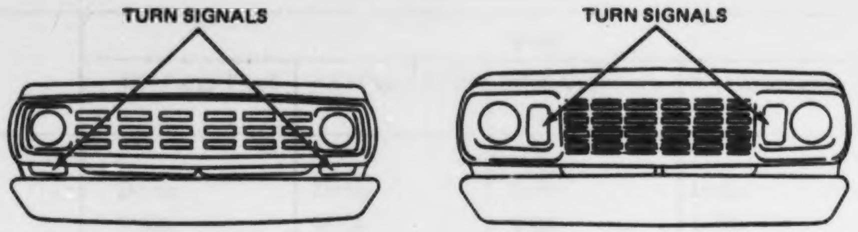
b. Models with a part number effectivity date before August 15, 1976, have a different grille and front turn signals than those manufactured after that date (figure 1-5).

1-9. Tabulated Data.

Basic information concerning the trucks is presented in table 1-1. Additional information, such as location of identification plates, may be found in TM 9-2320-266-10.

1-10. Torque Specifications.

Torque specifications for procedures set forth in this manual are listed in table 1-2.


TURN SIGNALS
TURN SIGNALS

BEFORE AUGUST 15, 1976

AFTER AUGUST 15, 1976

TA234965

Figure 1-5. Differences Between Grilles.

Table 1-1. Tabulated Data

Data	Model				
	4X4 Cargo Truck	4X2 Cargo Truck	4X4 Ambulance	4X2 Ambulance	4X4 Telephone Maintenance Truck
Vehicle:					
Make	Dodge	Dodge	Dodge	Dodge	Dodge
Model	W200	W200	W200	D200	D200
Weights:					
Curb	4648 lbs (2108 kg)	4217 lbs (1913 kg)	6116 lbs (2774 kg)	5684 lbs (2578 kg)	5014 lbs (2274 kg)
Payload	2500 lbs (1134 kg)	2500 lbs (1134 kg)	1200 lbs (544 kg) (5 litter patients)	1200 lbs (544 kg) (5 litter patients)	2000 lbs (907 kg)
GVW	7748 lbs (3515 kg)	7317 lbs (3319 kg)	7716 lbs (3500 kg)	7284 lbs (3304 kg)	8000 lbs (3639 kg)
GAWR (front)	3190 lbs (1447 kg)	2826 lbs (1282 kg)	3310 lbs (1502 kg)	2945 lbs (1336 kg)	2000 lbs (907 kg)
GAWR (rear)	4558 lbs (2068 kg)	4491 lbs (2037 kg)	4406 lbs (1999 kg)	4339 lbs (1968 kg)	5000 lbs (2270 kg)
Wheelbase	131.00 in (332.74 cm)	131.00 in (332.74 cm)	131.00 in (332.74 cm)	131.00 in (332.74 cm)	131.00 in (332.74 cm)
Track (front)	65.26 in (165.76 cm)	64.98 in (165.05 cm)	65.26 in (165.76 cm)	64.98 in (165.05 cm)	65.26 in (165.76 cm)
Track (rear)	64.00 in (162.56 cm)	64.00 in (162.56 cm)	64.00 in (162.56 cm)	64.00 in (162.56 cm)	64.00 in (162.56 cm)
Ground clearance	8.50 in (unloaded, 55 psi in rear) 8.0 in (loaded)	8.50 in (unloaded, 55 psi in rear) 8.0 in (loaded)	8.50 in (unloaded, 55 psi in rear) 8.0 in (loaded)	8.50 in (unloaded 55 psi in rear) 8.0 in (loaded)	8.50 in (unloaded, 55 psi in rear) 8.0 in (loaded)
Height (overall)	73.85 in (187.58 cm)	70.77 in (179.76 cm)	101.00 in (256.54 cm)	98.00 in (248.92 cm)	85.00 in (215.90 cm)
Length (overall)	218.74 in (555.6 cm)	218.74 in (555.6 cm)	215.42 in (547.17 cm)	215.42 in (547.17 cm)	214.00 in (543.56 cm)
Width (overall)	79.50 in (201.93 cm)	79.50 in (201.93 cm)	79.50 in (201.93 cm)	79.50 in (201.93 cm)	87.50 in (222.25 cm)
Engine:					
Type	v-type, overhead valve	v-type, overhead valve	v-type, overhead valve	v-type, overhead valve	v-type, overhead valve
Number of cylinders	8	8	8	8	8
Bore	3.91 in (9.93 cm)	3.91 in (9.93 cm)	3.91 in (9.93 cm)	3.91 in (9.93 cm)	3.91 in (9.93 cm)
Stroke	3.31 in (8.41 cm)	3.31 in (8.41 cm)	3.31 in (8.41 cm)	3.31 in (8.41 cm)	3.31 in (8.41 cm)
Piston displacement	318.3 cu in, (5.217 liters)	318.3 cu in (5.217 liters)	318.3 cu in (5.217 liters)	318.3 cu in (5.217 liters)	318.3 cu in (5.217 liters)
Compression ratio	8.6:1	8.6:1	8.6:1	8.6:1	8.6:1
Compression pressure	140 psi	140 psi	140 psi	140 psi	140 psi

Table 1-1. Tabulated Data – Continued

Data	Model				
	4X4 Cargo Truck	4X2 Cargo Truck	4X4 Ambulance	4X2 Ambulance	4X4 Telephone Maintenance Truck
Horsepower	150 bhp at 4000 rpm	150 bhp at 4000 rpm	150 bhp at 4000 rpm	150 bhp at 4000 rpm	150 bhp at 4000 rpm
Torque	230 ft-lbs at 2400 rpm	230 ft-lbs at 2400 rpm	230 ft-lbs at 2400 rpm	230 ft-lbs at 2400 rpm	230 ft-lbs at 2400 rpm
Ignition timing	2° before 0	2° before 0	2° before 0	2° before 0	2° before 0
Recommended fuel 1/	Regular, leaded gasoline	Regular, leaded gasoline	Regular, leaded gasoline	Regular, leaded gasoline	Regular, leaded gasoline
Carburetor:					
Choke unloader	0.310 in	0.310 in	0.310 in	0.310 in	0.310 in
Vacuum kick	0.110 in	0.110 in	0.110 in	0.110 in	0.110 in
Fast idle speed (rpm after 500 miles; engine warm)	1500	1500	1500	1500	1500
Axle ratios	4.10:1	4.10:1	4.10:1	4.10:1	4.10:1
Allowable speeds:					
First gear	25 mph (40 kph) [2]	25 mph (40 kph)	25 mph (40 kph) [2]	25 mph (40 kph)	25 mph [2] (40 kph)
Second gear	45 mph (72 kph) [2]	45 mph (72 kph)	45 mph (72 kph) [2]	45 mph (72 kph)	45 mph (72 kph)
Reverse	9 mph (14.5 kph) [2]	9 mph (14.5 kph)	9 mph (14.5 kph) [2]	9 mph (14.5 kph)	9 mph [2]
Drive	2/	–	2/	–	2/
Capacities:					
Fuel tank	20 gals (75.7 liters)	20 gals (75.7 liters)	20 gals (75.7 liters)	20 gals (75.7 liters)	20 gals (75.7 liters)
Crankcase:					
Without filter	5.0 qts (4.73 liters)	5.0 qts (4.73 liters)	5.0 qts (4.73 liters)	5.0 qts (4.73 liters)	5.0 qts (4.73 liters)
With filter	6.0 qts (5.68 liters)	6.0 qts (5.68 liters)	6.0 qts (5.68 liters)	6.0 qts (5.68 liters)	6.0 qts (5.68 liters)
Cooling system	18 qts (17 liters)	18 qts (17 liters)	18 qts (17 liters)	18 qts (17 liters)	18 qts (17 liters)
Differential:					
Rear	6 pts (2.84 liters)	6 pts (2.84 liters)	6 pts (2.84 liters)	6 pts (2.84 liters)	6 pts (2.84 liters)
Front (4X4 models only)	4 pts (1.89 liters)	–	4 pts (1.89 liters)	–	4 pts (1.89 liters)
Transmission	19 pts (8.99 liters)	19 pts (8.99 liters)	19 pts (8.99 liters)	19 pts (8.99 liters)	19 pts (8.99 liters)
Transfer case (4X4 models only)	9 pts (4.26 liters)	–	9 pts (4.26 liters)	–	9 pts (4.26 liters)

Table 1-1. Tabulated Data – Continued

Data	Model				
	4X4 Cargo Truck	4X2 Cargo Truck	4X4 Ambulance	4X2 Ambulance	4X4 Telephone Maintenance Truck
Tires:					
Size 3/	9.50R16.5D	9.50R16.5D	9.50R16.5D	9.50R16.5D	9.50R16.5D
Inflation pressures:					
Front	45 psi (3.16 kg/cm^2) (309 kPa)	45 psi (3.16 kg/cm^2) (309 kPa)	45 psi (3.16 kg/cm^2) (309 kPa)	45 psi (3.16 kg/cm^2) (309 kPa)	45 psi (3.16 kg/cm^2) (300 kPa)
Rear	55 psi (3.87 kg/cm^2) (380 kPa)	55 psi (3.87 kg/cm^2) (380 kPa)	55 psi (3.87 kg/cm^2) (380 kPa)	55 psi (3.87 kg/cm^2) (380 kPa)	55 psi (3.87 kg/cm^2) (380 kPa)
Maximum load capacity:					
Front	2030 lbs (920.8 kg)	2030 lbs (920.8 kg)	2030 lbs (920.8 kg)	2030 lbs (920.8 kg)	2030 lbs (920.8 kg)
Rear	2650 lbs (1202 kg)	2650 lbs (1202 kg)	2650 lbs (1202 kg)	2650 lbs (1202 kg)	2650 lbs (1202 kg)

1/ Type of gasoline: Designed for use with regular, leaded gas, but unleaded may be used.

2/ Maximum speeds: With the 4X4 transfer shift lever in LO and transmission in "1," the maximum allowable speed is 10 mph (16 kph). With the transfer in LO and the transmission in "2" or "D," the maximum allowable speed is 19 mph (31 kph). Higher speeds will over-rev the engine and can damage the transfer assembly.

3/ Tire size: The tire size number includes the letters "R" and "D." The "R" indicates that it is a radial tire. The "D" stands for the tire load range, which is a set of minimum test standards that has replaced the old ply-rating system. Load range "D" is a rating for a heavy-duty tire capable of carrying the maximum rated payload of the truck.

Table 1-2. Torque Specifications

Location	Ft-lbs	In-lbs
AXLES		
Center bearing bracket to frame bolt 7/16-14	50	-
Center bearing support to bracket bolt 7/16-14	50	-
Hub yoke (axle) 7/8-14	300	-
Hub yoke (transmission) 3/4-16	175	-
Roller bushing clamp bolt 1/4-28	14	170
Roller bushing clamp bolt 5/16-24	25	300
Parking brake to flange yoke nut 3/8-24	35	-
Axle shaft flange nut	70	-
Front axle shaft nut	100	
Brake support to axle nut	70	-
Companion flange nut (pinion nut)	260	-
Differential bearing cap bolt	90	-
Differential case half bolt	70	-
Housing cover capscrews	25	-
Ring gear capscrews	110	-
Front spring "U" bolt nuts	110	-
Rear springs "U" bolt nuts	180	
Universal joint clamp capscrews	17	200
BRAKES		
Wheel cylinder		
Front wheel cylinder connecting tube nut	8	95
Rear wheel brake support axle housing bolt nut	35	-
Wheel cylinder bleeder bolt	8	95
Wheel cylinder hose	25	-
Rear wheel cylinder mounting bolt	15	-
Front wheel brake mounting bolt	55	-
Wheel cylinder to support plate	25	
To brake line tubes (all)	8	100
To brake "T" (rear)	17	200
To wheel cylinders (all)	25	-
Power brake		
Power brake assembly to dash	17	200
Brake support plate		
Front (to steering knuckle) top attaching bolts	55	-
Master brake cylinder		
Master cylinder piston push rod end nut	30	-
Pedal bracket nut	20	-
Pedal shaft nut	20	-
Master cylinder to dash panel or booster front cover	17	200
Master cylinder pedal link bolt	30	-
Hydraulic brake lines		
Brake line tube nuts	8	100
Disc brake		
Adapter mounting bolts	100	-
Retainer and anti-rattle spring	17	200
ENGINE		
Spark plugs (24 mm, 3/4" reach, 0.035 gap, with gasket)	30	-
Exhaust pipe to manifold nuts	24	-
Exhaust manifold to cylinder head nuts	25	-
Intake manifold to cylinder head screws/nuts	35	-
Water pump bolts 3/8-16	30	-
Fan attaching bolts 5/16-18	17	200
Thermostat housing bolts 3/8-16	30	-
Shroud mounting screws 1/4-20	8	95
Shroud mounting nuts 1/4-20	8	95
Radiator mounting screws 3/8-16	30	-
Radiator mounting screws 1/4-20	6	75
Draincock on radiator tank 1/4-NPTF	13	150
Cylinder head bolt 1/2-13	95	-
SPRINGS AND SHOCK ABSORBERS		
Springs (front) 4X4)		
Shackle nut	80	-
Front eye bolt nut	80	-
Spring plate stud	105	-
Spring plate stud nut	110	-
"U" bolt nut	110	-
Front eye bolt	170	-
Spring (rear)		
Shackle bolt nut and front eye bolt 1/2-20	93	-
Shackle bolt nut and front eye bolt 5/8-18	160	-
Shackle bolt nut and front eye bolt 3/4-16	200	-
"U" bolt nut	180	-
Shock absorbers (front)		
Upper bushing retainer nut (4X2)	25	-
Lower mounting bolt (4X2)	17	200
Lower mounting nut (4X4)	55	-
Upper mounting nut stud (4X4)	55	-
Shock absorbers (rear)		
Lower mounting nut	85	-
Upper mounting nut	85	-
Jounce bumpers		
Front jounce bumper retaining nut (4X4)	30	-
Rear jounce bumper to frame bolt nut	17	200
Rear jounce bumper bracket to frame bolt nut	17	200
Sway bar (4X2)		
"U" shaped bracket retaining bolt nut	23	270
Link rod bushing retaining nut	8	100
Link bracket retaining bolt nut	17	200
Link bushing to spring plate bolt nut	75	-

Table 1-2. Torque Specifications—Continued

Location	Ft-lbs	In-lbs
SUSPENSION		
Axle housing cover	20	-
Ball joint nuts (4X2)		
Lower	135	-
Upper	135	-
Brake support to steering knuckle		
4X2	215	-
4X4	35	-
Companion flange nut (4X4)	210	-
Differential carrier cap (4X4)	80	-
Propeller shaft clamping screws	14	170
Shock absorber lower mounting		
4X2	17	200
4X4	55	-
Steering links (4X4)	47	-
Strut front mounting (4X2)	50	-
Strut rear mounting (4X2)	85	-
Tie rod clamping bolt (4X2)	13	160
Tie rod end nuts		
4X2	40	-
4X4	60	-
Upper control arm mounting (4X2)	70	-
Lower control arm mounting (4X2)	210	-
STEERING GEAR		
Worm bearing preload adjuster locknut	85	-
Side cover bolts	30	-
Sector shaft adjusting screw locknut	25	-
Coupling flange bolts	30	-
Coupling flange nuts	25	-
Wormshaft clamp bolt	30	-
Steering gear arm nut	180	-
Gear to frame bolts	50	-
TRANSFER CASE		
Adapter to transmission attaching bolt	31	-
Adapter to transfer case attaching bolts	30	-
Range box to chain case	30	-
Differential housing to chain case	30	-
Front input bearing retainer bolts	20	-
Front output front bearing retainer bolts	30	-
Front output rear bearing retainer bolts	30	-
Differential carrier bolt	55	-
TRANSFER CASE—Continued		
Rear output bearing retainer assembly bolts	30	-
Output shaft yoke nuts	120	-
Lockout shift poppet plug	20	-
Range shift poppet plug	20	-
Power takeoff cover bolts	15	-
Shifter assembly to adapter bolts	30	-
Shift lever to shifter assembly nut	30	-
Knob assembly jam nut	10	-
Range and locknut shift lever locknut	20	-
Shift rod swivel clamp screw	11	-
Filler plug	30	-
TRANSMISSION		
Cooler line fitting	9	110
Cooler line nut	7	85
Converter drain plug	8	90
Converter drive plate to crankshaft bolt	55	-
Converter drive plate to torque converter bolt	23	270
Extension housing to transmission case bolt	24	-
Extension housing to insulator mounting bolt	50	-
Governor body to support bolt	8	100
Kickdown band adjusting screw locknut	35	-
Kickdown lever shaft plug	13	150
Neutral safety switch	24	-
Oil pan bolt	13	150
Oil pump housing to transmission case bolt	15	175
Output shaft support bolt	13	150
Overrunning clutch cam set screw	3	40
Pressure test take-off plug	9	110
Reaction shaft support to oil pump bolt	13	160
Reverse band adjusting screw locknut	30	-
Speedometer drive clamp screw	8	100
Transmission to engine bolt	28	-
Valve body screw	3	35
Valve body to transmission case bolt	8	100

1-11. Radio Interference.

NOTE

The M880, M886, M890, and M893 trucks are not equipped with military standard electro-magnetic interference components, although they do contain commercial standard SAE suppression componentry. They should not be operated within 50 feet of a vehicle with communications equipment or any ground receiver/transmitter. The unsuppressed vehicles may interfere with operation of the communications equipment.

a. Some M880-series vehicles have military radio suppression componentry (table 1-3). The parts that are affected by this are:

- Starter relay capacitor
- Distributor cap
- Distributor rotor
- Spark plug shields
- Ignition coil shield
- Spark plug and ignition coil cables
- Voltage limiter
- Fender shields
- Ground strap
- Windshield wiper motor
- Heater motor

b. When replacing these parts, make sure you use the proper replacement parts listed in TM 9-2320-266-34P.

1-12. Standard Torque Values.

Table 1-4 provides standard torque values for specific size and grade of bolts and screws used as attaching hardware for components and parts. If specific torque values are not specified in the appropriate component paragraphs, tighten the attaching hardware to the torque values of table 1-4.

Table 1-3. Radio Interference Suppression.

Vehicle	Standard SAE Commercial Suppression Componentry Only	Military Suppression Componentry Also
M880	X	
M881		X
M882		X
M883		X
M884		X
M885		X
M886	X	
M888	X	
M890	X	X
M891		X
M892		
M893	X	

Table 1-4. Standard Torque Values

Bolt or Screw Size	Threads per inch	Diameter (inch)	SAE grade 2* Torque		SAE grade 5** Torque		SAE grade 7+ Torque		SAE grade 8++ Torque	
			Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
			pounds-inch							
4	40	0.1120	5	4	8	6	11	8	12	8
4	48	0.1120	6	5	9	7	12	9	13	10
6	32	0.1380	10	8	16	12	20	15	23	17
6	40	0.1380	12	9	18	13	22	17	29	19
8	32	0.1640	19	14	30	22	36	27	41	31
8	36	0.1640	20	15	31	23	38	29	43	32
10	24	0.1900	27	21	43	32	52	39	60	45
10	32	0.1900	31	23	49	36	60	45	68	51
1/4	20	0.2500	66	49	96	75	120	96	144	108
1/4	28	0.2500	76	56	120	86	144	108	168	120
			pounds-feet							
5/16	18	0.3125	11	8	17	13	21	16	25	18
5/16	24	0.3125	12	9	19	14	24	18	25	20
3/8	16	0.3750	20	15	30	23	40	30	45	35
3/8	24	0.3750	23	17	35	25	45	30	50	35
7/16	14	0.4375	30	24	50	35	60	45	70	55
7/16	20	0.4375	35	25	55	40	70	50	80	60
1/2	13	0.500	50	35	75	55	95	70	110	80
1/2	20	0.500	55	40	90	65	100	80	120	90
9/16	12	0.5625	65	50	110	80	135	100	150	110
9/16	18	0.5625	75	55	120	90	150	110	170	130
5/8	11	0.6250	90	70	150	110	190	140	220	170
5/8	18	0.6250	100	80	180	130	210	160	240	180
3/4	10	0.7500	160	120	260	200	320	240	380	280
3/4	16	0.7500	180	140	300	220	360	280	420	320
7/8	9	0.8750	140	110	400	300	520	400	600	460
7/8	14	0.8750	155	120	440	320	580	440	660	500
1	8	1.0000	220	160	580	440	800	600	900	680
1	12	1.0000	240	170	640	480	860	660	1000	740
1-1/8	7	1.1250	300	220	800	600	1120	840	1280	960
1-1/8	12	1.1250	340	260	880	660	1260	940	1440	1080
1-1/4	7	1.2500	420	320	1120	840	1580	1100	1820	1360
1-1/4	12	1.2500	460	360	1240	920	1760	1320	2000	1500
1-3/8	6	1.3750	560	420	1460	1100	2080	1560	2380	1780
1-3/8	12	1.3750	640	460	1680	1260	2380	1780	2720	2040
1-1/2	6	1.50000	740	560	1940	1460	2780	2080	3160	2360
1-1/2	12	1.5000	840	620	2200	1640	3100	2320	3560	2660

*Head marking-none **Head marking +Head marking ++Head marking

CHAPTER 2

TROUBLESHOOTING

2-1. General Information.

This chapter contains information for locating and correcting many of the troubles which may develop in the truck. Testing procedures for most systems and components are included in the maintenance paragraphs for the system or component affected. The "trouble trees" (figures 2-1 through 2-5) in this chapter are designed as a quick-reference diagnostic guide.

2-2. Troubleshooting Procedures.

a. Organization of the Trouble Trees. The trouble trees are organized as a direct continuation of the trouble trees contained in TM 9-2320-266-20. Where possible, they are organized into the sequence most likely to locate and correct malfunctions with a minimum of testing.

b. Using the Trouble Trees. To use the trees, first locate the tree for the malfunctioning system (engine, etc.). Then, look across the top line of boxes until you find the trouble symptom (engine will not crank, etc.). Finally, check the test/malfunction boxes listed underneath the trouble symptom (check amp gage, etc.) until you find the solution to the problem. Always perform all applicable tests before replacing a component.

c. Malfunctions at Lower Maintenance Levels. Malfunctions correctable at the organizational level have been left out of the trouble trees in this manual. When suggested corrections involve complex testing or repairs, Direct Support and General Support personnel should first insure that all organizational-level tests and corrections have been taken care of by organizational maintenance.

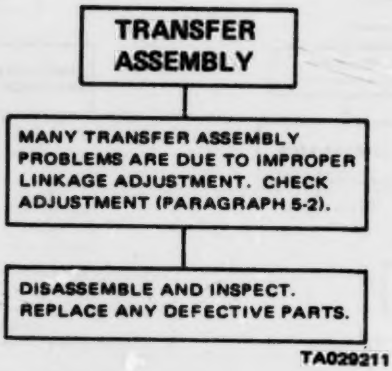

TRANSFER ASSEMBLY
MANY TRANSFER ASSEMBLY PROBLEMS ARE DUE TO IMPROPER LINKAGE ADJUSTMENT. CHECK ADJUSTMENT (PARAGRAPH 5-2).
DISASSEMBLE AND INSPECT. REPLACE ANY DEFECTIVE PARTS.
TA020211

Figure 2-1. Troubleshooting the Transfer.

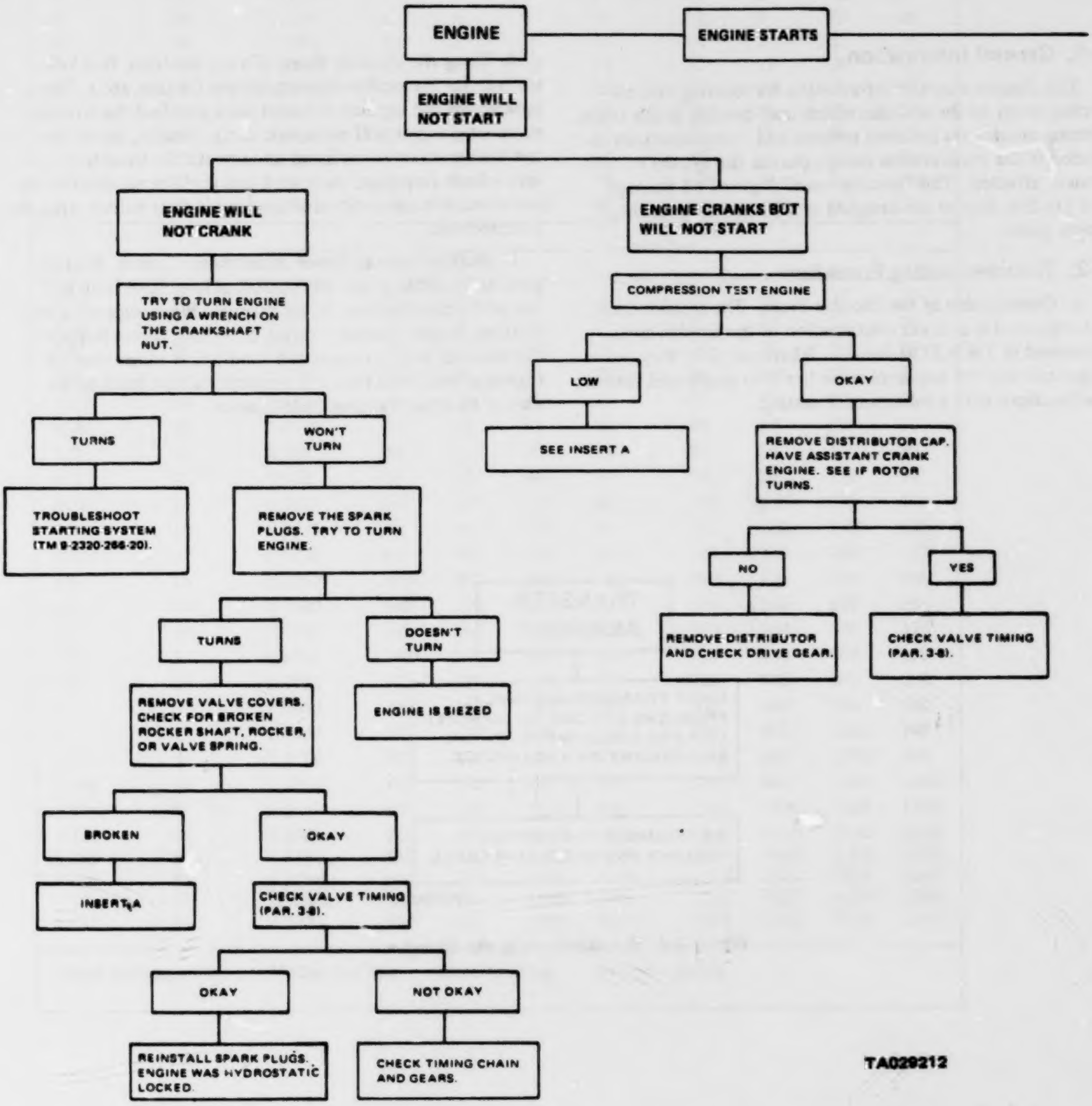

ENGINE
ENGINE STARTS
ENGINE WILL NOT START
ENGINE WILL NOT CRANK
ENGINE CRANKS BUT WILL NOT START
TRY TO TURN ENGINE USING A WRENCH ON THE CRANKSHAFT NUT.
COMPRESSION TEST ENGINE
LOW
OKAY
SEE INSERT A
REMOVE DISTRIBUTOR CAP. HAVE ASSISTANT CRANK ENGINE. SEE IF ROTOR TURNS.
TURNS
WON'T TURN
TROUBLESHOOT STARTING SYSTEM (TM 9-2320-266-20).
REMOVE THE SPARK PLUGS. TRY TO TURN ENGINE.
NO
YES
REMOVE DISTRIBUTOR AND CHECK DRIVE GEAR.
CHECK VALVE TIMING (PAR. 3-8).
TURNS
DOESN'T TURN
REMOVE VALVE COVERS. CHECK FOR BROKEN ROCKER SHAFT, ROCKER, OR VALVE SPRING.
ENGINE IS SIEZED
BROKEN
OKAY
INSERT A
CHECK VALVE TIMING (PAR. 3-8).
OKAY
NOT OKAY
REINSTALL SPARK PLUGS. ENGINE WAS HYDROSTATIC LOCKED.
CHECK TIMING CHAIN AND GEARS.
TA029212

Figure 2-2. Troubleshooting the Engine (1 of 4).

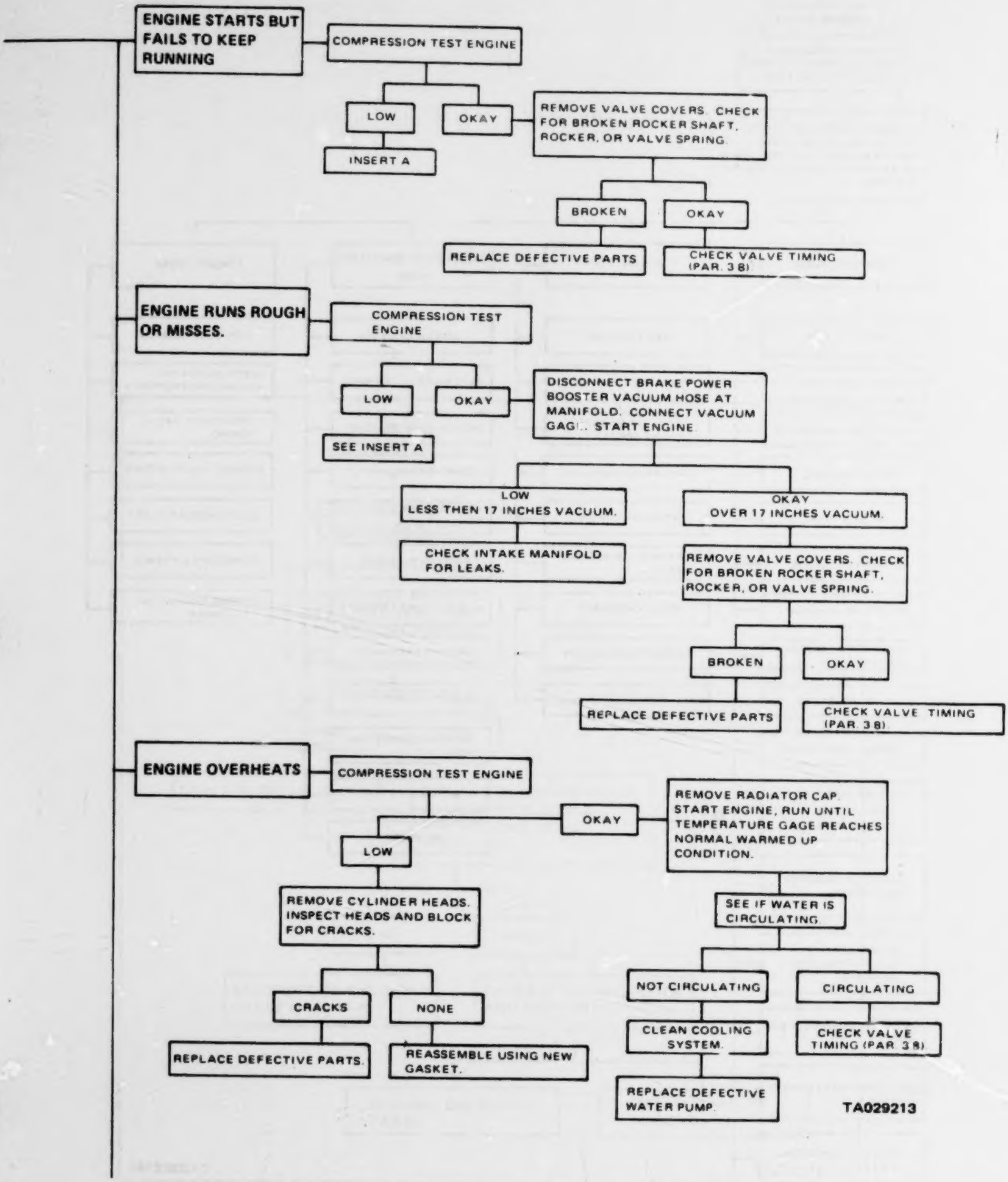

ENGINE STARTS BUT FAILS TO KEEP RUNNING
COMPRESSION TEST ENGINE
LOW
OKAY
INSERT A
REMOVE VALVE COVERS. CHECK FOR BROKEN ROCKER SHAFT, ROCKER, OR VALVE SPRING.
BROKEN
OKAY
REPLACE DEFECTIVE PARTS
CHECK VALVE TIMING (PAR. 38)
ENGINE RUNS ROUGH OR MISSES.
COMPRESSION TEST ENGINE
LOW
OKAY
SEE INSERT A
DISCONNECT BRAKE POWER BOOSTER VACUUM HOSE AT MANIFOLD. CONNECT VACUUM GAGE. START ENGINE.
LOW LESS THEN 17 INCHES VACUUM.
OKAY OVER 17 INCHES VACUUM.
CHECK INTAKE MANIFOLD FOR LEAKS.
REMOVE VALVE COVERS. CHECK FOR BROKEN ROCKER SHAFT, ROCKER, OR VALVE SPRING.
BROKEN
OKAY
REPLACE DEFECTIVE PARTS
CHECK VALVE TIMING (PAR. 38)
ENGINE OVERHEATS
COMPRESSION TEST ENGINE
OKAY
REMOVE RADIATOR CAP. START ENGINE, RUN UNTIL TEMPERATURE GAGE REACHES NORMAL WARMED UP CONDITION.
LOW
REMOVE CYLINDER HEADS. INSPECT HEADS AND BLOCK FOR CRACKS.
SEE IF WATER IS CIRCULATING.
CRACKS
NONE
NOT CIRCULATING
CIRCULATING
REPLACE DEFECTIVE PARTS.
REASSEMBLE USING NEW GASKET.
CLEAN COOLING SYSTEM.
CHECK VALVE TIMING (PAR. 38)
REPLACE DEFECTIVE WATER PUMP.
TA029213

Figure 2-2. Troubleshooting the Engine (2 of 4).

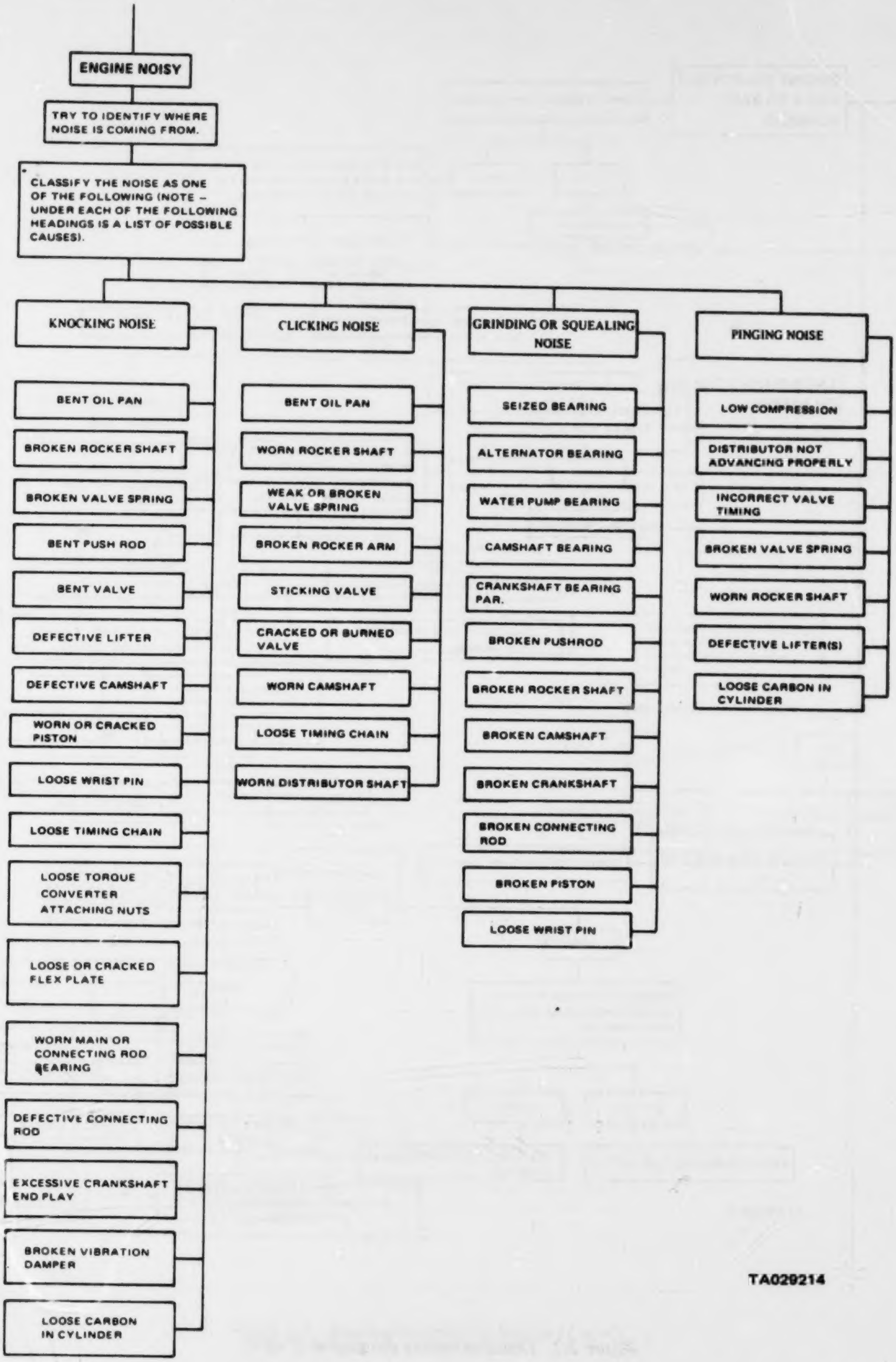

ENGINE NOISY
TRY TO IDENTIFY WHERE NOISE IS COMING FROM.
CLASSIFY THE NOISE AS ONE OF THE FOLLOWING (NOTE – UNDER EACH OF THE FOLLOWING HEADINGS IS A LIST OF POSSIBLE CAUSES).
KNOCKING NOISE
BENT OIL PAN
BROKEN ROCKER SHAFT
BROKEN VALVE SPRING
BENT PUSH ROD
BENT VALVE
DEFECTIVE LIFTER
DEFECTIVE CAMSHAFT
WORN OR CRACKED PISTON
LOOSE WRIST PIN
LOOSE TIMING CHAIN
LOOSE TORQUE CONVERTER ATTACHING NUTS
LOOSE OR CRACKED FLEX PLATE
WORN MAIN OR CONNECTING ROD BEARING
DEFECTIVE CONNECTING ROD
EXCESSIVE CRANKSHAFT END PLAY
BROKEN VIBRATION DAMPER
LOOSE CARBON IN CYLINDER
CLICKING NOISE
BENT OIL PAN
WORN ROCKER SHAFT
WEAK OR BROKEN VALVE SPRING
BROKEN ROCKER ARM
STICKING VALVE
CRACKED OR BURNED VALVE
WORN CAMSHAFT
LOOSE TIMING CHAIN
WORN DISTRIBUTOR SHAFT
GRINDING OR SQUEALING NOISE
SEIZED BEARING
ALTERNATOR BEARING
WATER PUMP BEARING
CAMSHAFT BEARING
CRANKSHAFT BEARING PAR.
BROKEN PUSHROD
BROKEN ROCKER SHAFT
BROKEN CAMSHAFT
BROKEN CRANKSHAFT
BROKEN CONNECTING ROD
BROKEN PISTON
LOOSE WRIST PIN
PINGING NOISE
LOW COMPRESSION
DISTRIBUTOR NOT ADVANCING PROPERLY
INCORRECT VALVE TIMING
BROKEN VALVE SPRING
WORN ROCKER SHAFT
DEFECTIVE LIFTER(S)
LOOSE CARBON IN CYLINDER
TA029214

Figure 2-2. Troubleshooting the Engine (3 of 4)

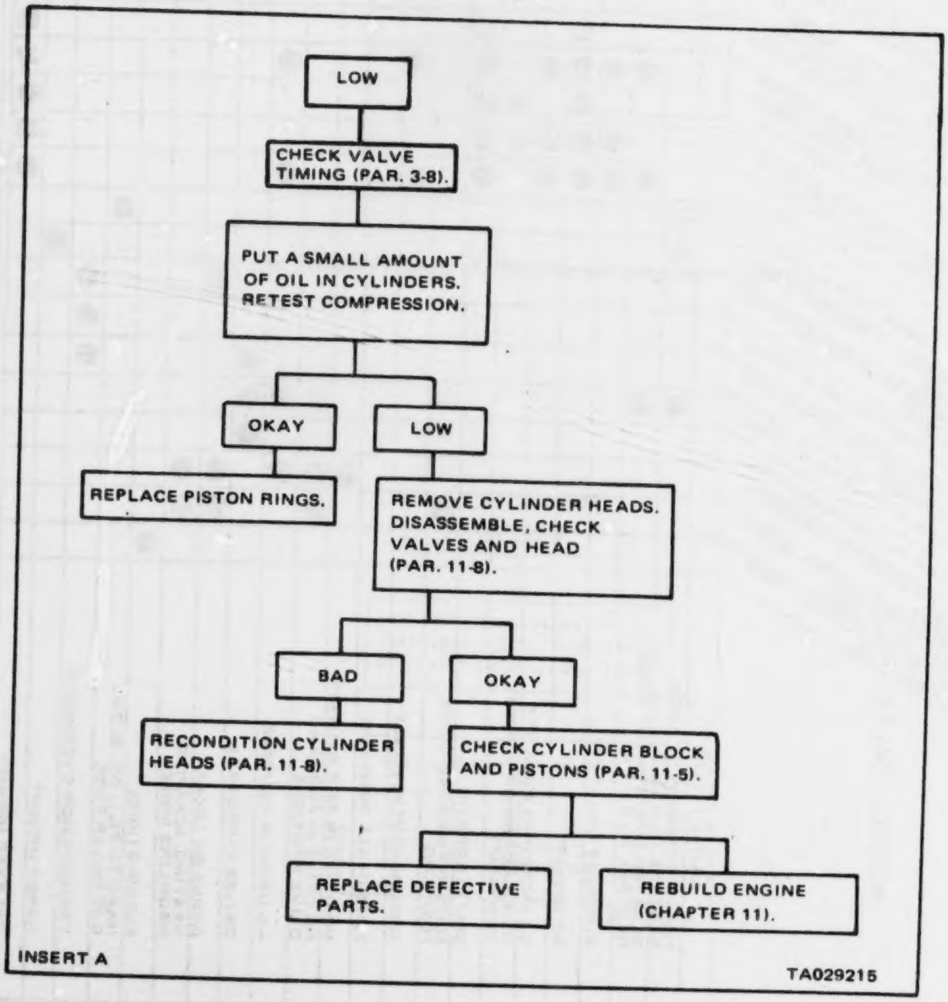

LOW
CHECK VALVE TIMING (PAR. 3-8).
PUT A SMALL AMOUNT OF OIL IN CYLINDERS. RETEST COMPRESSION.
OKAY
LOW
REPLACE PISTON RINGS.
REMOVE CYLINDER HEADS. DISASSEMBLE, CHECK VALVES AND HEAD (PAR. 11-8).
BAD
OKAY
RECONDITION CYLINDER HEADS (PAR. 11-8).
CHECK CYLINDER BLOCK AND PISTONS (PAR. 11-5).
REPLACE DEFECTIVE PARTS.
REBUILD ENGINE (CHAPTER 11).
INSERT A
TA029215

Figure 2-2. Troubleshooting the Engine (4 of 4)

TRANSMISSION

POSSIBLE CAUSE CONDITION	OVERRUNNING CLUTCH INNER RACE DAMAGED.	OVERRUNNING CLUTCH WORN, BROKEN OR SEIZED.	PLANETARY GEAR SETS BROKEN OR SEIZED.	REAR CLUTCH DRAGGING.	WORN OR FAULTY REAR CLUTCH.	INSUFFICIENT CLUTCH PLATE CLEARANCE.	FAULTY COOLING SYSTEM.	KICKDOWN BAND ADJUSTMENT TOO TIGHT.	HYDRAULIC PRESSURE TOO HIGH.	BREATHER CLOGGED.	WORN OR FAULTY FRONT CLUTCH.	KICKDOWN SERVO BAND OR LINKAGE MALFUNCTION.	GOVERNOR MALFUNCTION.	WORN OR BROKEN REACTION SHAFT SUPPORT SEAL RINGS.	GOVERNOR SUPPORT SEAL RINGS BROKEN OR WORN.	OUTPUT SHAFT BEARING AND/OR BUSHING DAMAGED.	OVERRUNNING CLUTCH NOT HOLDING.	KICKDOWN BAND OUT OF ADJUSTMENT.	INCORRECT THROTTLE LINKAGE ADJUSTMENT.	AERATED FLUID.	WORN OR BROKEN INPUT SHAFT SEAL RINGS.	FAULTY OIL PUMP.	OIL FILTER CLOGGED.	INCORRECT GEARSHIFT CONTROL LINKAGE ADJUSTMENT.	LOW-REVERSE SERVO, BAND OR LINKAGE MALFUNCTION.	VALVE BODY MALFUNCTION OR LEAKAGE.	LOW-REVERSE BAND OUT OF ADJUSTMENT.	HYDRAULIC PRESSURES TOO LOW.
HARSH ENGAGEMENT FROM NEUTRAL TO D OR R					●				●																	●		
DELAYED ENGAGEMENT FROM NEUTRAL TO D OR R					●						●			●						●	●	●	●	●	●	●		●
RUNAWAY UPSHIFT											●	●		●					●	●			●			●		●
NO UPSHIFT											●	●	●	●	●				●					●		●		●
3-2 KICKDOWN RUNAWAY											●	●		●				●	●	●						●		●
NO KICKDOWN OR NORMAL DOWNSHIFT												●	●						●							●		
SHIFTS ERRATIC											●	●	●	●	●					●		●	●	●		●		●
SLIPS IN FORWARD DRIVE POSITIONS		●			●												●		●	●	●	●	●	●		●		●
SLIPS IN REVERSE ONLY											●			●						●		●		●	●	●	●	●
SLIPS IN ALL POSITIONS																				●	●	●	●			●		●
NO DRIVE IN ANY POSITION			●																			●	●			●		●
NO DRIVE IN FORWARD DRIVE POSITIONS		●	●		●												●				●					●		●
NO DRIVE IN REVERSE			●		●						●			●										●	●	●	●	●
DRIVES IN NEUTRAL				●	●	●																		●		●		
DRAGS OR LOCKS		●	●					●																			●	
GRATING, SCRAPING GROWLING NOISE		●	●													●		●									●	
BUZZING NOISE	●																			●						●		
HARD TO FILL, OIL BLOWS OUT FILLER TUBE										●										●			●					
TRANSMISSION OVERHEATS						●	●	●														●		●				●
HARSH UPSHIFT									●									●	●									●
DELAYED UPSHIFT											●	●	●	●	●			●	●									

TA029216

Figure 2-3. Troubleshooting the Transmission.

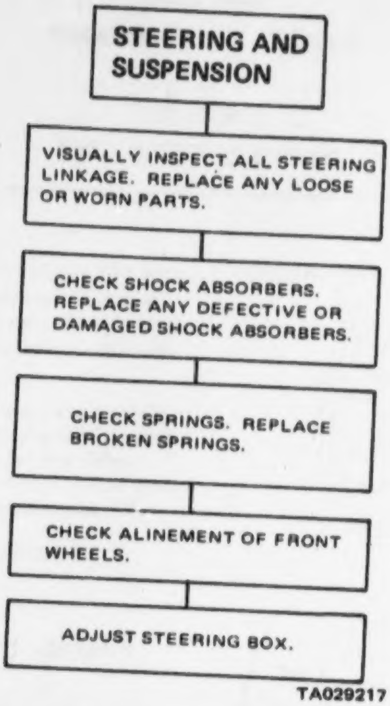

STEERING AND SUSPENSION
VISUALLY INSPECT ALL STEERING LINKAGE. REPLACE ANY LOOSE OR WORN PARTS.
CHECK SHOCK ABSORBERS. REPLACE ANY DEFECTIVE OR DAMAGED SHOCK ABSORBERS.
CHECK SPRINGS. REPLACE BROKEN SPRINGS.
CHECK ALINEMENT OF FRONT WHEELS.
ADJUST STEERING BOX.
TA029217

Figure 2-4. Troubleshooting the Steering and Suspension Systems.

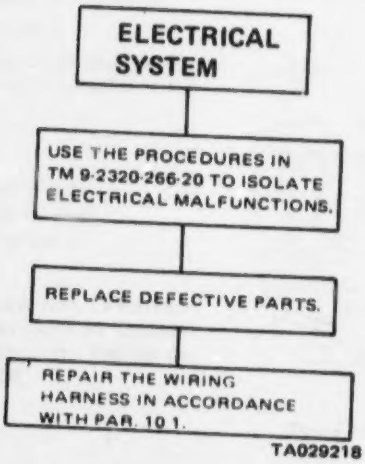

ELECTRICAL SYSTEM
USE THE PROCEDURES IN TM 9-2320-266-20 TO ISOLATE ELECTRICAL MALFUNCTIONS.
REPLACE DEFECTIVE PARTS.
REPAIR THE WIRING HARNESS IN ACCORDANCE WITH PAR. 10 1.
TA029218

Figure 2-5. Troubleshooting the Electrical System.

PART TWO
REPAIRS ON THE VEHICLE

CHAPTER 3
REPAIR OF THE ENGINE

3-1. General.

a. The trucks have a 318 cubic-inch V-8 engine with overhead valves. Bore is 3.91 inches and stroke is 3.31 inches. The engine operates with a compression ratio of 8.6:1, developing 150 bhp at 4,000 rpm. The engines have a solid-state, electronic ignition system.

b. Some truck engines are equipped with parts for radio suppression (refer to paragraph 1-11). Replacement engines don't have the military suppression components. When changing engines, remove the suppression parts from the old engine, and install them on the replacement engine.

3-2. Cylinder Head Covers (Valve Covers).

a. Disconnect the PCV valve.

b. Disconnect the oil breather.

c. Remove the attaching bolts from the valve covers.

d. Remove the valve covers.

e. Clean the gasket surfaces of the valve covers and the cylinder head.

f. Using a new gasket, reverse the above procedure to reinstall the valve covers.

3-3. Rocker Arms and Shaft Assemblies.

a. Removal and Disassembly.

(1) Remove the cylinder head cover (valve cover).

(2) Remove the five rocker shaft attaching bolts.

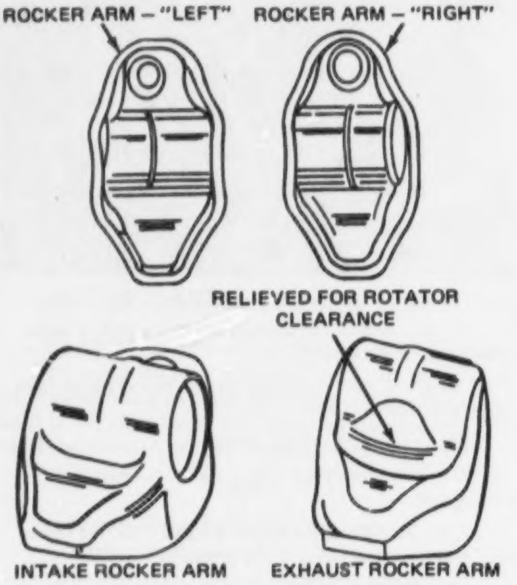
(3) Lift the rocker shaft off the head.

(4) Slide the rockers off the shaft. Lay them on a work bench in the same order that they are installed on the shaft.

NOTE

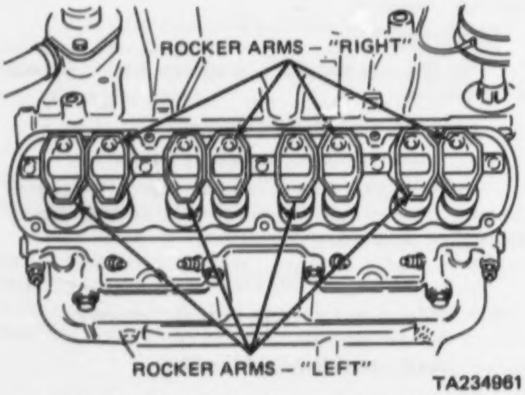
When you reassemble the rocker shaft assembly, the rockers must be installed in the same position they were in before disassembly.

b. Assembly and Installation. Rocker arms are reassembled on the shaft in groups of two. See figure 3-1 for identification of left-side and right-side rocker arms. Position the arms on the shaft as shown in figure 3-2.



TA234960

Figure 3-1. Intake and Exhaust Rocker Arm Identification.



TA234961

Figure 3-2. Proper Rocker Arm Location on Shaft.

(1) Install the rocker arm and shaft assemblies with the notch on the end of the rocker shaft pointing to the centerline of the engine. The notch should face the front of the engine on the left bank, and the rear of the engine on the right bank.

NOTE

Be sure to install the long, stamped steel retainers in the number two and four positions.

(2) Tighten the rocker shaft attaching bolts to 18 ft-lbs.

3-4. Intake Manifold.

a. Removal.

(1) Disconnect the negative (ground) cable at the battery.

(2) Drain the cooling system.

(3) Remove the alternator.

(4) Remove the carburetor air cleaner and disconnect the fuel line at the carburetor.

(5) Disconnect the carburetor linkage and tie it out of the way.

(6) Remove the distributor (TM 9-2320-266-20).

(7) Disconnect the vacuum advance and PCV valve hoses at the carburetor.

(8) Disconnect the brake booster vacuum hose from the intake manifold.

(9) Disconnect the coil wires.

(10) Disconnect the wire from the temperature sending unit.

(11) Disconnect the upper radiator hose, the heater hose, and the bypass hose at the intake manifold.

(12) Remove the intake manifold bolts.

(13) Remove the intake manifold, ignition coil, and carburetor as an assembly.

(14) Remove the carburetor and ignition coil from the intake manifold.

b. Inspection.

(1) Clean the manifold with solvent. Blow it dry with compressed air.

(2) Inspect the manifold for cracks.

(3) Inspect all mating surfaces for flatness.

(4) Inspect the exhaust crossover passages for carbon deposits. If the passages are coated with hard black carbon, scrape them clean and sandblast them.

NOTE

Before sandblasting the manifold, remove the temperature sending unit and the thermostat (TM 9-2320-266-20).

c. Installation.

(1) Clean all gasket surfaces.

(2) Cut a 3-inch strip of sealer material into four equal parts and install them under the gasket lock tabs.

(3) Set the new gaskets in place with the bead down.

(4) Set the intake manifold in place. Check to make sure the gaskets are still in place.

(5) Install the 12 attaching screws finger-tight.

(6) Tighten the attaching screws to 25 ft-lbs, using the tightening sequence shown in figure 3-3. Then tighten them in the same sequence to 35 ft-lbs.

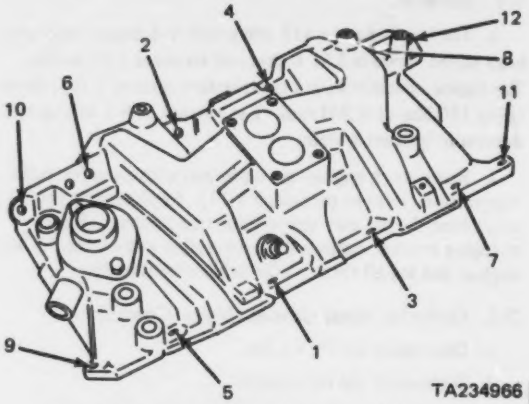


Figure 3-3. Intake Manifold Tightening Sequence.

(7) Install the carburetor, ignition coil, and distributor.

(8) Install the upper radiator, heater, and bypass hoses.

(9) Connect the wires to the coil and the temperature sending unit.

(10) Connect the brake booster vacuum hose, the PCV valve hose, and the vacuum advance line. Connect the carburetor linkage and the carburetor fuel supply line.

(11) Install the alternator.

(12) Close the radiator draincock and fill the cooling system.

(13) Install the carburetor air cleaner and connect the battery ground cable.

3-5. Exhaust Manifolds.

To remove the exhaust manifolds, disconnect the exhaust pipe, remove the manifold attaching nuts and bolts, and remove the manifold. To install the exhaust manifolds, reverse the above procedure and tighten the mounting bolts to 25 ft-lbs.

3-6. Cylinder Heads.

The chrome alloy, cast-iron cylinder heads are shown in figure 3-4. They are held in place by 10 bolts.

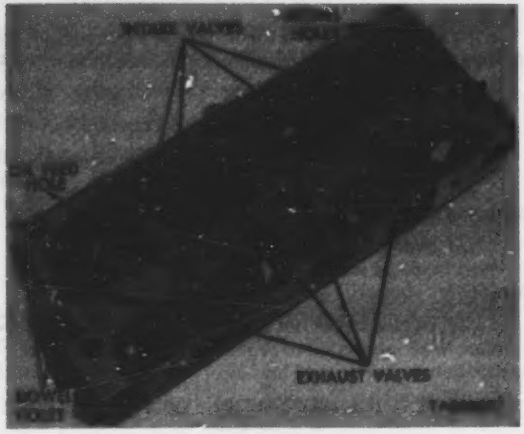


Figure 3-4. Cylinder Head Assembly.

a. Removal.

(1) Disconnect the negative (ground) cable at the battery.

(2) Drain the cooling system.

(3) Remove the alternator.

(4) Remove the carburetor air cleaner and fuel line.

(5) Remove the vacuum control hose between the carburetor and the distributor.

■ *(6)* Remove the distributor (TM 9-2320-266-20).

(7) Disconnect the coil wires and the temperature gage sending unit wire.

(8) Remove the heater hoses and the bypass hose.

(9) Disconnect the carburetor linkage and tie it out of the way.

(10) Remove the PCV valve hose.

(11) Remove the brake booster vacuum hose.

(12) Remove the valve covers

(13) Remove the intake manifold, ignition coil, and carburetor as an assembly.

(14) Remove the exhaust manifolds.

(15) Remove the rocker arms and shaft assemblies. Remove the push rods and tag them to insure installation in the original location.

(16) Remove the bolts from each cylinder head, and remove the cylinder heads.

(17) Remove the spark plugs.

b. Installation.

(1) Clean all head gasket surfaces. Remove all burrs.

(2) Inspect all surfaces for flatness with a straightedge. Maximum warpage is 0.009 inch per foot.

(4) Carefully position the cylinder heads on the engine block.

(5) Install the cylinder head bolts. Tighten them to 50 ft-lbs in the sequence shown in figure 3-5. Then, repeating the sequence, tighten the head bolts to 95 ft-lbs.

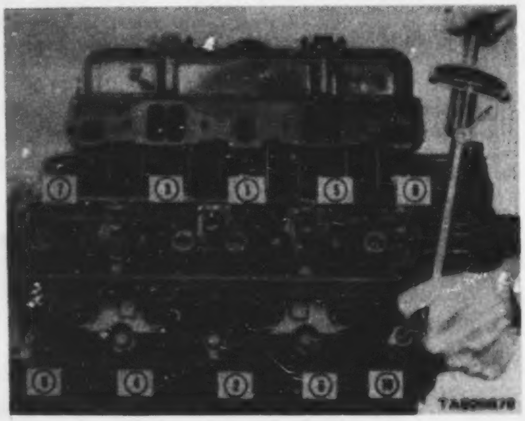


Figure 3-5. Cylinder Head Tightening Sequence.

(6) Inspect the push rods, replacing worn or bent rods.

(7) Install the push rods in their original locations. Install the rocker arm and shaft assemblies. Be sure the notch points to the centerline of the engine and faces forward on the left bank and to the rear on the right bank.

NOTE

Be sure to install the long, stamped steel retainers in the number two and four positions (see figure 3-2). Tighten them to 18 ft-lbs.

(8) Cut the 3-inch strip of sealer material into four equal parts and install them under cylinder head gasket lock tabs.

(9) Position the rubber seals over the rails at the front and rear of the cylinder block. The center hole in the seals must engage the dowel pins and end holes locked in the tangs of the head gasket.

(10) Install the gaskets with the bead down.

(11) Position the intake manifold on the cylinder block and cylinder heads. After the intake manifold is in place, inspect it to make sure the seals are in place.

(12) Install the 12 attaching capscrews finger-tight. Tighten capscrews one through four to 25 ft-lbs in the tightening sequence shown in figure 3-3. Retighten capscrews one through four to 35 ft-lbs, and follow by retightening the remaining capscrews to 35 ft-lbs in the sequence shown.

the exhaust manifolds and tighten them

(14) Adjust the spark plugs to 0.035 inch gap and install them.

(15) Install the distributor (TM 9-2320-266-20).

(16) Install the coil wires, the temperature gage sending unit wire, the heater hoses, and the bypass hose.

(17) Install the vacuum control hose between the carburetor and distributor.

(18) Install the accelerator linkage and adjust it as necessary.

(19) Install the distributor cap and wires.

(20) Install the fuel line, alternator, and drive belt. Tighten the alternator mounting bolt to 30 ft-lbs. Tighten the adjusting strap bolt to 17 ft-lbs.

(21) Position the new valve cover gaskets and install and tighten the cylinder head covers.

(22) Install the PCV valve.

(23) Fill the cooling system.

(24) Install the battery ground cable.

3-7. Hydraulic Tappets.

a. Preliminary to Checking the Hydraulic Tappets. Before disassembling any part of the engine to correct tappet noise, read the oil pressure at the gage and check the oil level. The pressure should be between 30 and 80 lbs at 2,000 rpm. An excessively high or low oil level can cause noisy tappets.

b. Diagnosing Tappet Noise.

(1) To determine the source of tappet noise, remove the valve covers and operate the engine at idle.

(2) Feel each valve spring or rocker arm to detect a noisy tappet. The noisy tappet causes the affected spring or rocker arm to vibrate or operate roughly.

NOTE

Worn valve guides or cocked springs are sometimes mistaken for noisy tappets. If such is the case, the noise may be dampened by applying side thrust on the valve spring. If the noise is not appreciably reduced, it is probably in the tappet. Inspect the rocker arm, push rod sockets, and push rod ends for wear.

(3) Valve tappet noise ranges from light noise to a heavy click. A light noise is usually caused by a poor seal between the tappet wall and the plunger. This requires replacing the tappet. It may also be caused by the plunger partially sticking in the tappet body cylinder. A heavy click is caused by a tappet check valve not seating, or by foreign particles becoming wedged between the plunger and the tappet body. This causes the plunger to stick in the down position. This heavy click will be accompanied by excessive clearance between the valve stem and the rocker arm as the valve closes. In either case, remove the tappet assembly for inspection and cleaning.

c. Removal. The tappets can be removed without removing the cylinder heads by following this procedure:

(1) Remove the valve covers.

(2) Remove the intake manifold (paragraph 3-4).

(3) Remove the rocker arms and the shaft assembly.

(4) Remove the push rods and tag them to insure installation in their original location.

(5) Slide tool C-4129-A through the opening in the cylinder head and seat the tool firmly in the head of the tappet.

(6) Pull the tappet out of the bore with a twisting motion. If all tappets are to be removed, tag them to insure installation in their original location.

CAUTION

The plunger and tappet bodies are not interchangeable. The plunger and valve must always be fitted to the original body.

d. Installation.

(1) Lubricate the tappets.

(2) Install the tappets and push rods in their original positions.

(3) Install the rocker arm and shaft assembly.

(4) Install the intake manifold (paragraph 3-4).

(5) Start and operate the engine. Warm it up to normal operating temperature.

CAUTION

To prevent damage to the valve mechanism, don't run the engine above fast idle until all hydraulic tappets have filled with oil and have become quiet.

3-8. Valve Timing.

a. Turn the crankshaft until the number six exhaust valve is closing and the number six intake valve is opening.

b. Insert a 1/4-inch spacer between the rocker arm pad (figure 3-6) and the stem tip of the number one intake valve (second valve on the left bank).

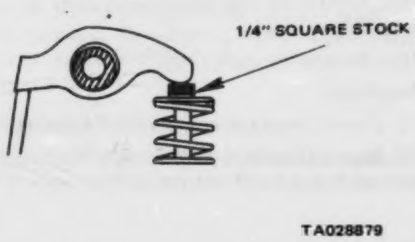


Figure 3-6. Inserting Spacer.

c. Install a dial indicator so the plunger contacts the valve spring retainer as nearly perpendicular as possible.

d. Allow the spring load to bleed the tappet down, giving in effect a solid tappet. Zero the indicator.

e. Rotate the crankshaft clockwise until the valve has lifted 0.010 inch. The timing of the crankshaft pulley should now read from 10 degrees before "0" (TDC) to 2 degrees after "0." Remove the spacer.

CAUTION

Do not turn the crankshaft any further clockwise, as the valve spring might bottom and damage the tappet.

f. If the reading is not within specified limits:

(1) Check the sprocket index marks.

(2) Inspect the timing chain for wear.

(3) Check the accuracy of the "0" TDC mark on the timing indicator.

3-9. Timing Chain Cover, Oil Seal, and Chain.

a. Removing the Cover.

(1) Disconnect the negative (ground) cable at the battery.

(2) Drain the cooling system and remove the radiator, fan belt, and water pump assembly.

(3) Remove the pulley from the vibration damper. Remove the bolt and washer securing the vibration damper on the crankshaft.

(4) Install a puller and remove the vibration damper from the end of the crankshaft (figure 3-7).

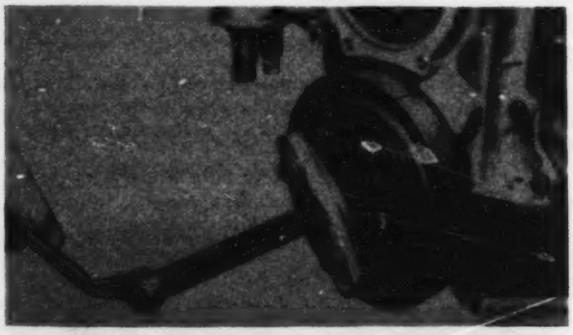


Figure 3-7. Removing Vibration Damper Assembly.

(5) Remove the fuel lines and fuel pump.

(6) Loosen the oil pan bolts and remove the front bolt at each side.

(7) Remove the chain case cover and gasket. Use extreme caution to avoid damaging the oil pan gasket.

b. Measuring Timing Chain for Stretch.

(1) Place a scale next to the timing chain so that any movement of the chain may be measured.

(2) Place a torque wrench and socket over the camshaft sprocket attaching bolt and apply torque in the direction of the crankshaft rotation to take up the slack; apply 30 ft-lbs if the cylinder heads are installed, or 15 ft-lbs if the cylinder heads are removed. After torque is applied to the camshaft sprocket bolt, do not permit the crankshaft to move. It may be necessary to block the crankshaft to prevent rotation.

(3) Holding a scale with the dimensional reading even with the edge of a chain link, apply torque in the reverse direction (30 ft-lbs with cylinder heads installed or 15 ft-lbs with cylinder heads removed). Note the amount of chain movement (figure 3-8).

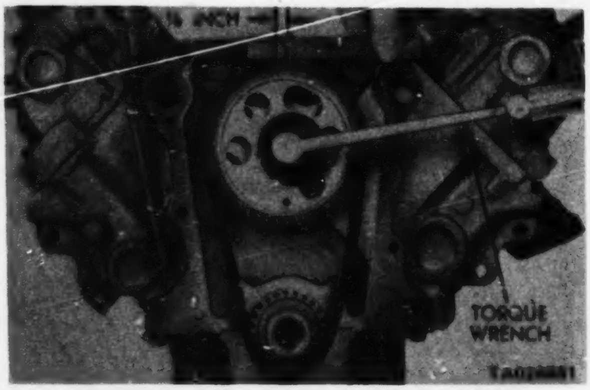


Figure 3-8. Measuring Timing Chain Stretch.

(4) Install a new timing chain, if its movement exceeds one-eighth inch.

c. Replacing Timing Chain and Sprockets. Replace the timing chain, and the camshaft and crankshaft sprockets as a set if any one of the three is bad.

(1) Remove the timing chain cover (*a*, above).

(2) Remove the cup washer that attaches the sprocket to the camshaft. Remove the fuel pump eccentric. Remove the timing chain and the crankshaft and camshaft sprockets as an assembly.

(3) To install a new chain, remove the distributor and oil pump distributor drive gear. Use tool C-3509 to avoid contact between the camshaft and the welch plug in the rear of the engine block.

(4) Locate the tool against the rear side of the cam gear and attach the tool with the distributor retainer plate bolt, as shown in figure 3-9. (The figure shows accessories removed, for clarity).

(5) Place the camshaft and crankshaft sprockets on the bench with the timing marks on the centerline through both bores.

(6) Place the timing chain around both sprockets.

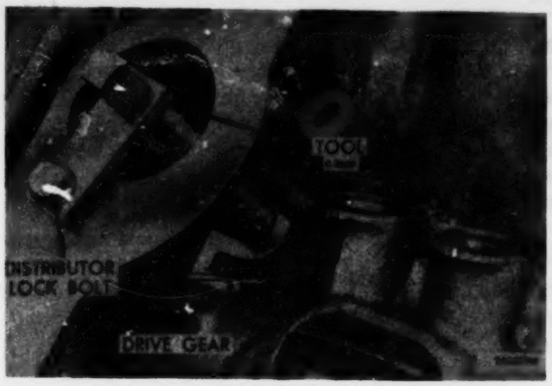


Figure 3-9. Camshaft Holding Tool C-3509.

(7) Turn the crankshaft and camshaft to line up with the keyway locations in their respective sprockets.

(8) Lift the sprockets and chain (keep the sprockets tight against the chain in the position described).

(9) Slide both sprockets simultaneously over their respective shafts. Use a straightedge to check alinement of timing marks (figure 3-10).

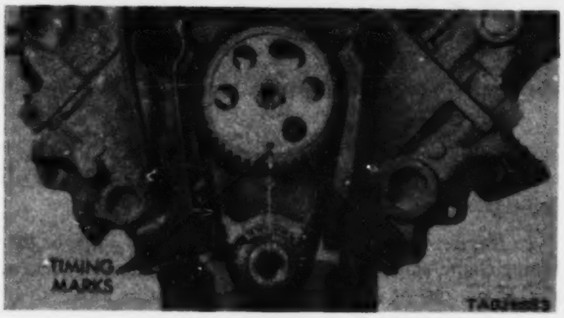


Figure 3-10. Alinement of Timing Marks.

(10) Install the fuel pump eccentric, cup washer, and camshaft bolt. Tighten the bolt to 35 ft-lbs.

(11) Measure the camshaft end play. If it is over 0.010 inch, install a new thrust plate.

(12) Replace the timing chain cover oil seal (*d*, below).

(13) Replace the timing chain cover (*e*, below).

d. Replacing the Oil Seal (Cover Removed).

(1) Using a drift and hammer, tap lightly at several places around the seal case to deform the oil seal case inward.

(2) Engage the seal case with vise grips. Twist and pull on the vise grips at several places around the seal case to remove it.

(3) Insert the installing screw through the installing plate (part of tool C-3506).

(4) Insert the installing screw and plate assembly, facing upward, through the seal opening working inside of the chain case cover.

(5) Place the seal in the cover opening, with the seal lips down. Place the seal installing plate in the new seal, with the protective recess toward the lip of the seal retainer (tool SP5598, part of tool C-3506).

(6) Install a flat washer and nut on the installing screw, hold the screw, and tighten the nut.

(7) The seal is properly installed when the seal case is tight against the face of the cover.

e. Installing the Cover.

(1) Be sure the mating surfaces are clean and free from burrs.

(2) Using a new gasket, install the chain case cover to avoid damaging the oil pan gasket. First, tighten the chain case cover capscrews to 30 ft-lbs. Then tighten the oil pan capscrews to 17 ft-lbs.

(3) Lubricate the seal lip. Position the vibration damper hub slot on the key in the crankshaft, and slide it on the crankshaft.

(4) Tap the vibration damper on the crankshaft. Then install the retainer bolt with a washer and tighten it to 135 ft-lbs.

(5) Position the pulley on the vibration damper and attach it with bolts and lockwashers. Tighten to 17 ft-lbs.

(6) Install the fuel pump and fuel lines.

(7) Install the water pump and housing assembly, using new gaskets. Tighten bolts to 30 ft-lbs.

(8) Install the radiator, fan and belt, and hoses. Close the drains.

(9) Fill the cooling system.

(10) With the timing indicator on "0," install the distributor drive gear with the slot pointing to the first intake manifold bolt on the left side of the engine (figure 3-11).

(11) Reconnect the battery ground cable.

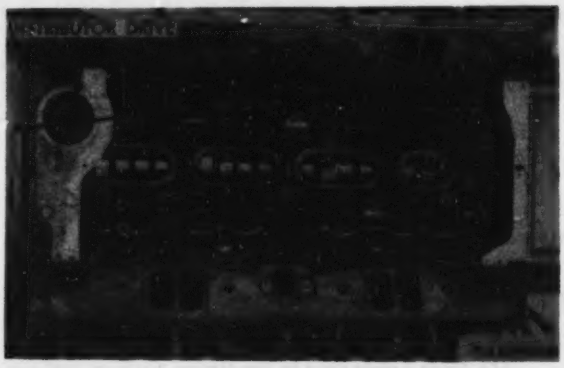


Figure 3-11. Position of Distributor Drive Gear.

3-10. Oil Pan Replacement.

a. Drain the engine oil.

b. Remove the left side support, connecting the converter housing to the cylinder block.

c. Remove the oil pan attaching bolts. Lower the pan down and to the rear.

d. To install, use a new gasket and reverse the above procedure. Tighten the capscrews to 17 ft-lbs.

3-11. Oil Pump Replacement.

a. Drain the engine oil and remove the pan (paragraph 3-10).

b. Remove the oil pump mounting bolts, and remove the pump from the rear main bearing cap.

c. To install, use a new gasket and reverse the above procedure. Tighten the mounting bolts to 15 ft-lbs.

3-12. Rear Main Oil Seal.

a. Description. Service seals are of split rubber (neoprene) composition. The seals make it possible to replace the upper rear seal without removing the crankshaft. Use the upper and lower seals as a set. The set cannot be combined with the rope seal. A rope seal is supplied in the engine gasket package and used when the engine is rebuilt.

b. Replacement Procedures.

(1) With the oil pan and oil pump removed, remove the rear main bearing cap.

(2) Remove the lower rope oil seal by prying it from the side with a small screwdriver.

(3) With rope seals, remove the upper half by screwing a small screw into the end of the seal. Pull the seal out with pliers while rotating the crankshaft. Use needle nose pliers to pull out neoprene-type seals.

CAUTION

Always wipe the crankshaft surface clean, then oil it lightly before installing a new seal.

(4) Oil the seal lip lightly with engine oil.

(5) Position the new upper half of the rear main oil seal in the groove, and slide it into position while rotating the crankshaft.

(6) Install the lower half of the seal into the rear main bearing cap, with the paint stripe to the rear.

(7) Install the rear main bearing cap. Tighten bolts alternately to 85 ft-lbs. See figures 3-12 and 3-13.

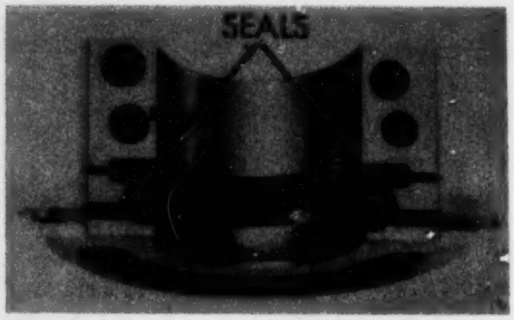
3-13. Engine Removal and Installation.

a. Removal.

(1) Disconnect the negative (ground) cable at the battery and at the cylinder head.

(2) Drain the cooling system.

(3) Scribe the hood hinge outlines on the hood and remove the hood.



TA028885

Figure 3-12. Rear Main Bearing Cap.

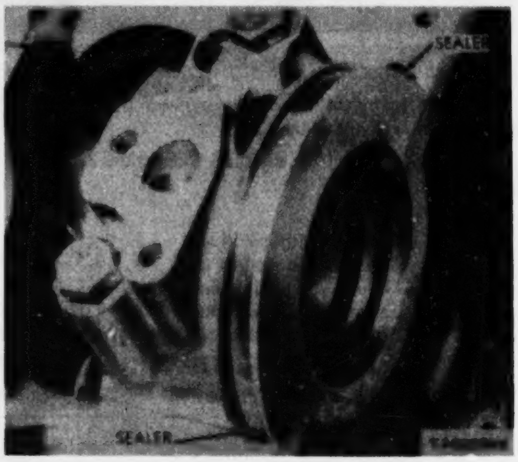


Figure 3-13. Oil Pan End Seal at Rear Bearing.

(4) Remove the fan shroud from the radiator and rest it on the water pump.

(5) Disconnect the radiator hoses, heater hoses, and transmission lines. Remove the radiator and surge tank.

(6) Remove the fan shroud from the engine compartment.

(7) Loosen the alternator adjusting bolt and remove the fan belt.

(8) Remove the fan, spacer, pulley, and attaching bolts as an assembly.

(9) Remove the air cleaner and carburetor. Install a lifting eye (tool C-4384, figure 3-14).

Figure 3-14. Installation of Lifting Eye.

(10) Disconnect the fuel line between the frame and the fuel pump. Cap the line.

(11) Disconnect the electrical connections at the following points:

- Alternator
- Primary ignition coil lead
- Temperature sending unit
- Oil pressure sending unit
- Engine-to-body ground
- Starter relay-to-solenoid wires (at the solenoid).

(12) Remove the throttle linkage from the intake manifold. Secure the linkage and all loose wiring to the firewall.

(13) Disconnect the exhaust pipe at the manifolds.

(14) Remove the starter motor.

(15) Remove the bell housing bolts and the inspection plate. Attach a "C" clamp on the front bottom of the transmission torque converter housing. This will prevent the torque converter from slipping out of the housing when the engine is lifted.

(16) Remove the torque converter drive plate nuts from the drive plate. Mark the converter and drive plate to aid in positioning them for reassembly.

(17) Support the transmission with a transmission jack and attach a chain hoist to the engine lifting eye.

(18) Remove the engine front mount bolts and lift out the engine. Install it in the engine test stand.

NOTE

If the engine is being replaced by a different engine, remove all radio suppression equipment from the old engine, and install it on the replacement engine. Also, remove the throttle/transmission linkage. The replacement engine might not come equipped with these parts or the parts might be different.

b. Installation. To install the engine, reverse the procedure in *a,* above. See table 1-2 for torque specifications. After installation, test drive the truck and make any necessary adjustments.

3-14. Replacing the Front Motor Mounts.

a. General Information. Replace only one motor mount at a time. If both front motor mounts are bad, replace one and then repeat steps 2 through 4, below, separately for the other mount.

b. Replacement Procedure.

(1) Remove the carburetor. Install the engine lifting adapter to the intake manifold.

(2) Remove the motor mount insulator stop stud nut and washer. Remove the stud.

(3) Raise the engine just enough to clear the mount, and remove the mount.

(4) To install a new mount, reverse the above procedure.

CHAPTER 4

REPAIR OF THE TRANSMISSION

4-1. General.

The transmission (figures 4-1 and 4-1.1) combines a torque converter and a fully automatic, three-speed gear system. The converter housing and the transmission case are an integral aluminum casting. The transmission consists of two multiple disc clutches, an overrunning clutch, two servos and bands, and two planetary gear sets to provide three forward ratios and a reverse ratio. The common sun gear of the planetary gear sets is connected to the front clutch by a driving shell splined to the sun gear and to the front clutch retainer. The hydraulic system consists of an oil pump and a single valve body which contains all of the valves except the governor valve.

4-2. Hydraulic Control System.

Figures 4-1.2 through 4-9 show schematic diagrams of the various valves which are used in the different gear selector positions. Table 4-1 gives the same information in tabulated form. The automatic hydraulic control system has four important functions to perform. In a general way, the components of any automatic control system may be grouped into the following basic groups: The pressure supply system, the pressure regulating valves, the flow control valves, and the clutches and band servos. These are described in the following paragraphs.

Table 4-1. Elements in Use at Each Position of the Selector Lever

Lever position	Gear ratio	Safety neutral	Parking sprag	Clutches			Bands	
				Front	Rear	Over-running	(Kickdown) front	(Low-rev) rear
P-Park		X	X					
R-Reverse	2.21			X				X
N-Neutral		X						
D-Drive								
First	2.45				X	X		
Second	1.45				X		X	
Direct	1.00			X	X			
2-Second								
First	2.45				X	X		
Second	1.45				X		X	
1-Low (first)	2.45				X			X

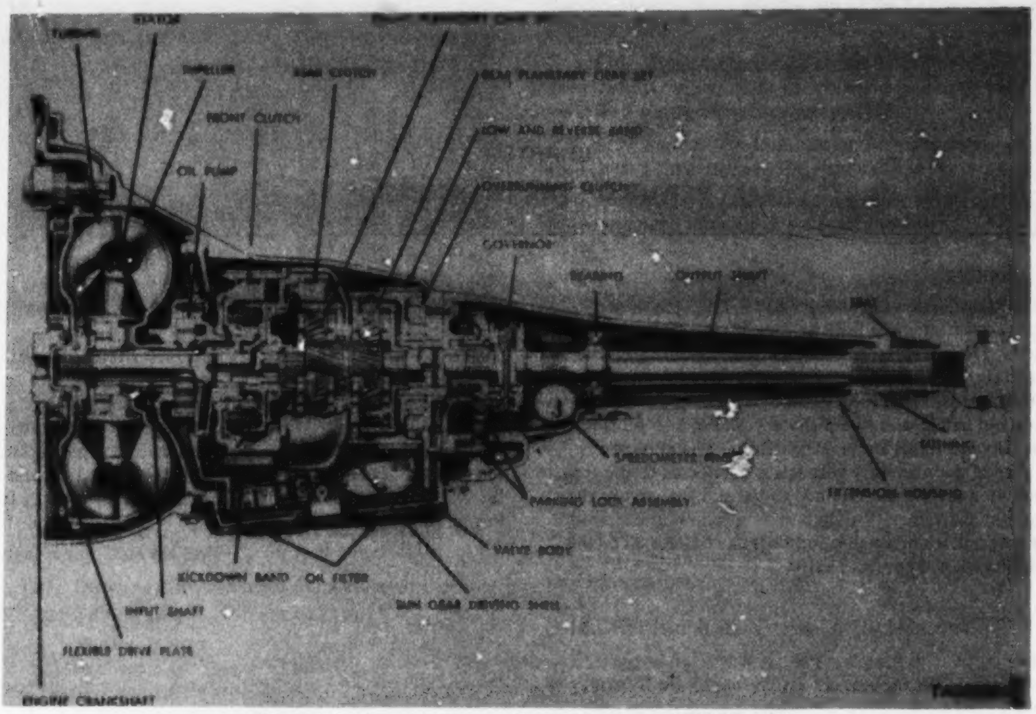

TURBINE
STATOR
FRONT PLANETARY GEAR SET
IMPELLER
REAR CLUTCH
REAR PLANETARY GEAR SET
FRONT CLUTCH
LOW AND REVERSE BAND
OIL PUMP
OVERRUNNING CLUTCH
GOVERNOR
BEARING
OUTPUT SHAFT
SEAL
BUSHING
SPEEDOMETER PINION
PARKING LOCK ASSEMBLY
EXTENSION HOUSING
VALVE BODY
KICKDOWN BAND
OIL FILTER
SUN GEAR DRIVING SHELL
INPUT SHAFT
FLEXIBLE DRIVE PLATE
ENGINE CRANKSHAFT

Figure 4-1. Transmission and Torque Converter (4X2 Models).

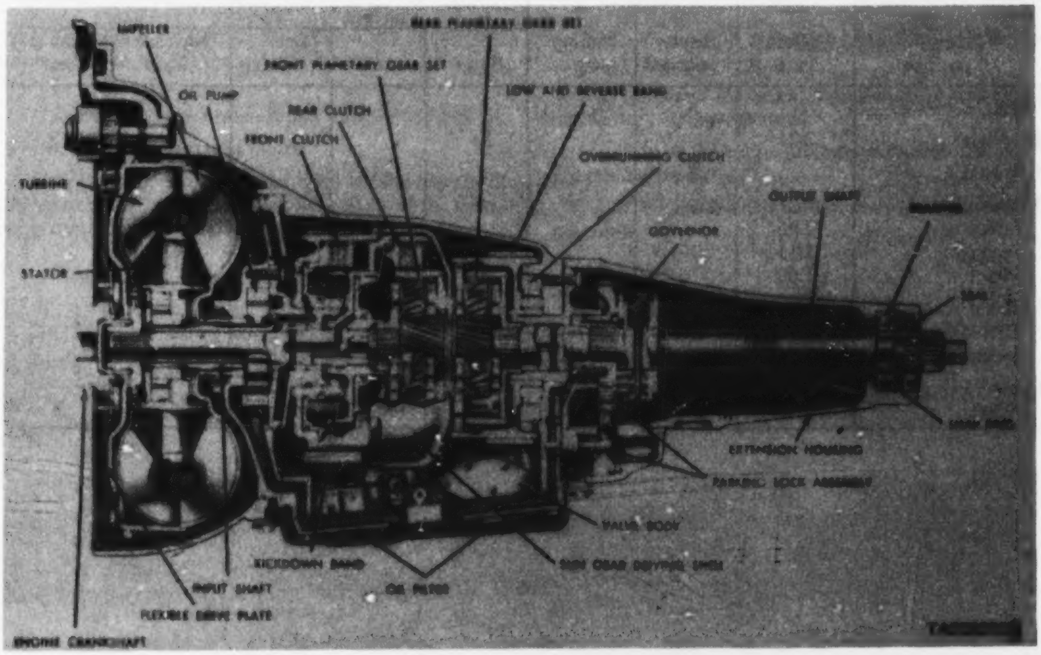

IMPELLER
REAR PLANETARY GEAR SET
FRONT PLANETARY GEAR SET
OIL PUMP
REAR CLUTCH
LOW AND REVERSE BAND
FRONT CLUTCH
OVERRUNNING CLUTCH
TURBINE
OUTPUT SHAFT
BEARING
GOVERNOR
SEAL
STATOR
SNAP RING
EXTENSION HOUSING
PARKING LOCK ASSEMBLY
VALVE BODY
KICKDOWN BAND
SUN GEAR DRIVING SHELL
INPUT SHAFT
OIL FILTER
FLEXIBLE DRIVE PLATE
ENGINE CRANKSHAFT

Figure 4-1.1. Transmission and Torque Converter (4X4 Models).

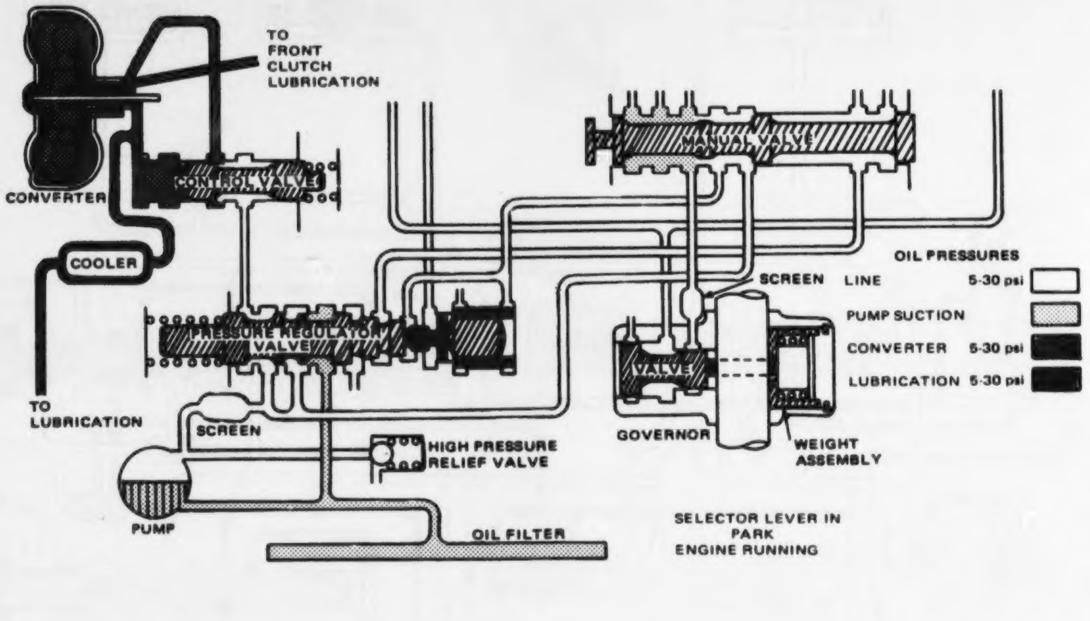

TO
FRONT
CLUTCH
LUBRICATION
MANUAL VALVE
CONTROL VALVE
CONVERTER
COOLER
OIL PRESSURES
LINE 5-30 psi
PUMP SUCTION
CONVERTER 5-30 psi
LUBRICATION 5-30 psi
SCREEN
PRESSURE REGULATOR VALVE
VALVE
TO
LUBRICATION
SCREEN
GOVERNOR
WEIGHT
ASSEMBLY
HIGH PRESSURE
RELIEF VALVE
PUMP
OIL FILTER
SELECTOR LEVER IN
PARK
ENGINE RUNNING
TO
FRONT
CLUTCH
LUBRICATION
MANUAL VALVE
CONTROL VALVE
CONVERTER
COOLER
OIL PRESSURES
LINE 57 psi
PUMP SUCTION
CONVERTER 10-57 psi
LUBRICATION 5-30 psi
SCREEN
PRESSURE REGULATOR VALVE
VALVE
TO
LUBRICATION
SCREEN
GOVERNOR
WEIGHT
ASSEMBLY
HIGH PRESSURE
RELIEF VALVE
PUMP
OIL FILTER
SELECTOR LEVER IN
NEUTRAL
ENGINE RUNNING
TA028888

Figure 4-1.2. Park and Neutral.

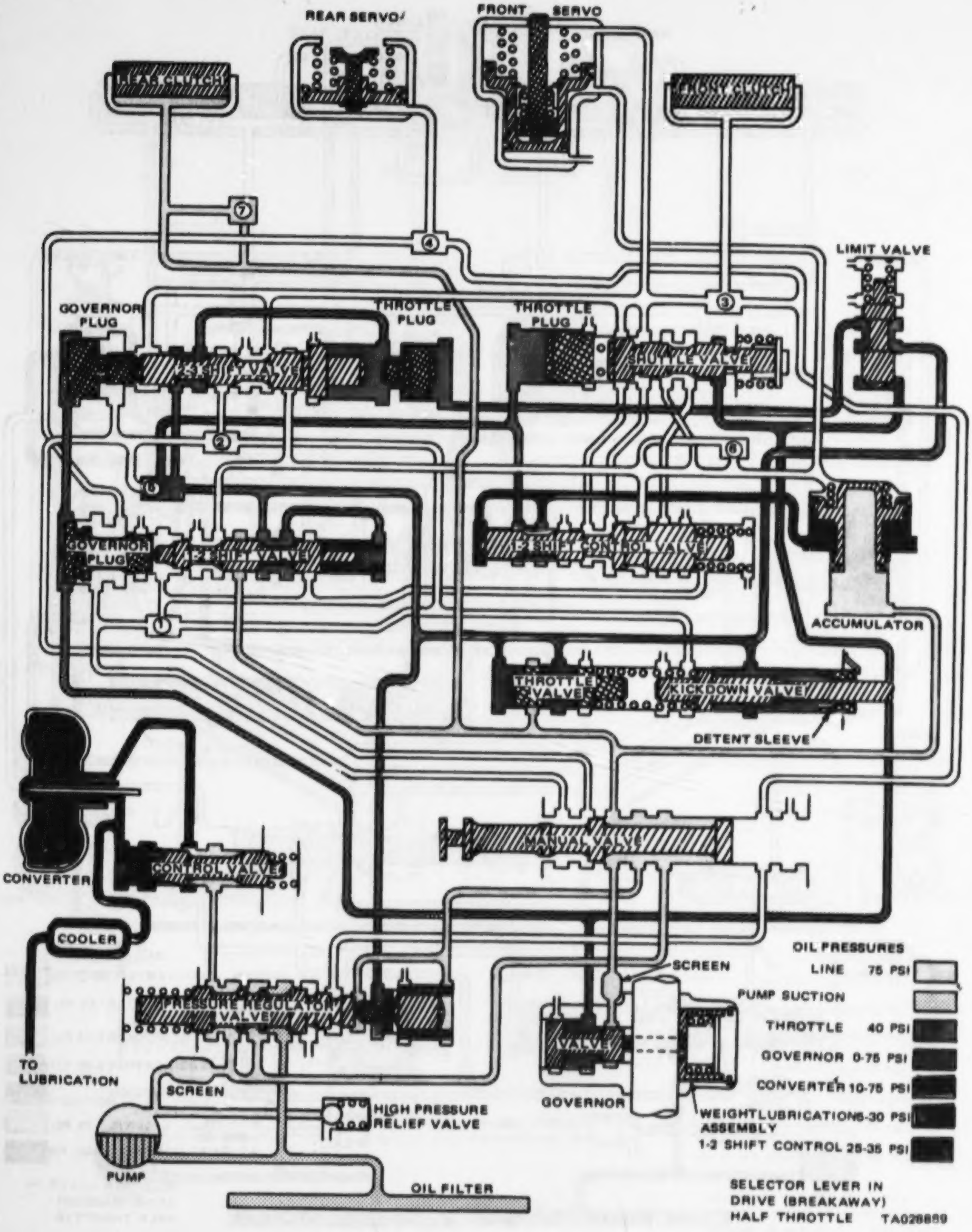

REAR SERVO
FRONT SERVO
REAR CLUTCH
FRONT CLUTCH
⑦
④
③
②
⑥
⑤
①
LIMIT VALVE
GOVERNOR PLUG
THROTTLE PLUG
2-3 SHIFT VALVE
THROTTLE PLUG
SHUTTLE VALVE
GOVERNOR PLUG
1-2 SHIFT VALVE
1-2 SHIFT CONTROL VALVE
ACCUMULATOR
THROTTLE VALVE
KICKDOWN VALVE
DETENT SLEEVE
MANUAL VALVE
CONVERTER
CONTROL VALVE
COOLER
TO LUBRICATION
PRESSURE REGULATOR VALVE
SCREEN
HIGH PRESSURE RELIEF VALVE
PUMP
OIL FILTER
SCREEN
VALVE
GOVERNOR
WEIGHT ASSEMBLY
OIL PRESSURES
LINE 75 PSI
PUMP SUCTION
THROTTLE 40 PSI
GOVERNOR 0-75 PSI
CONVERTER 10-75 PSI
LUBRICATION 5-30 PSI
1-2 SHIFT CONTROL 25-35 PSI
SELECTOR LEVER IN
DRIVE (BREAKAWAY)
HALF THROTTLE
TA028859

Figure 4-2. Drive–Breakaway.

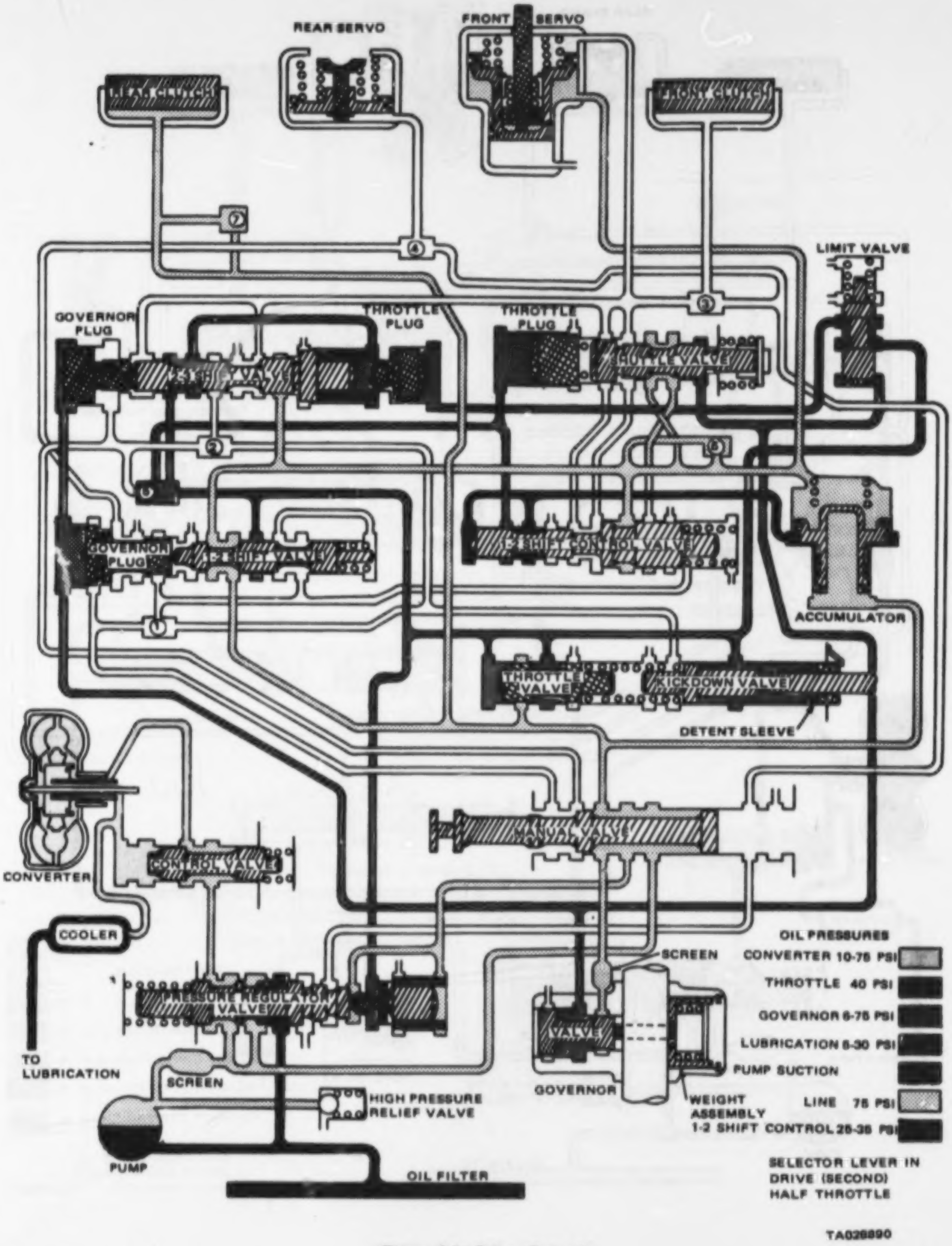

REAR SERVO
FRONT SERVO
REAR CLUTCH
FRONT CLUTCH
7
4
3
LIMIT VALVE
GOVERNOR PLUG
THROTTLE PLUG
2-3 SHIFT VALVE
THROTTLE PLUG
THROTTLE VALVE
2
6
1
GOVERNOR PLUG
1-2 SHIFT VALVE
1-2 SHIFT CONTROL VALVE
ACCUMULATOR
THROTTLE VALVE
KICKDOWN VALVE
DETENT SLEEVE
MANUAL VALVE
CONVERTER
CONTROL VALVE
COOLER
SCREEN
PRESSURE REGULATOR VALVE
TO LUBRICATION
SCREEN
HIGH PRESSURE RELIEF VALVE
PUMP
OIL FILTER
VALVE
GOVERNOR
WEIGHT ASSEMBLY
OIL PRESSURES
CONVERTER 10-75 PSI
THROTTLE 40 PSI
GOVERNOR 6-75 PSI
LUBRICATION 5-30 PSI
PUMP SUCTION
LINE 75 PSI
1-2 SHIFT CONTROL 25-35 PSI
SELECTOR LEVER IN
DRIVE (SECOND)
HALF THROTTLE
TA028890

Figure 4-3. Drive–Second.

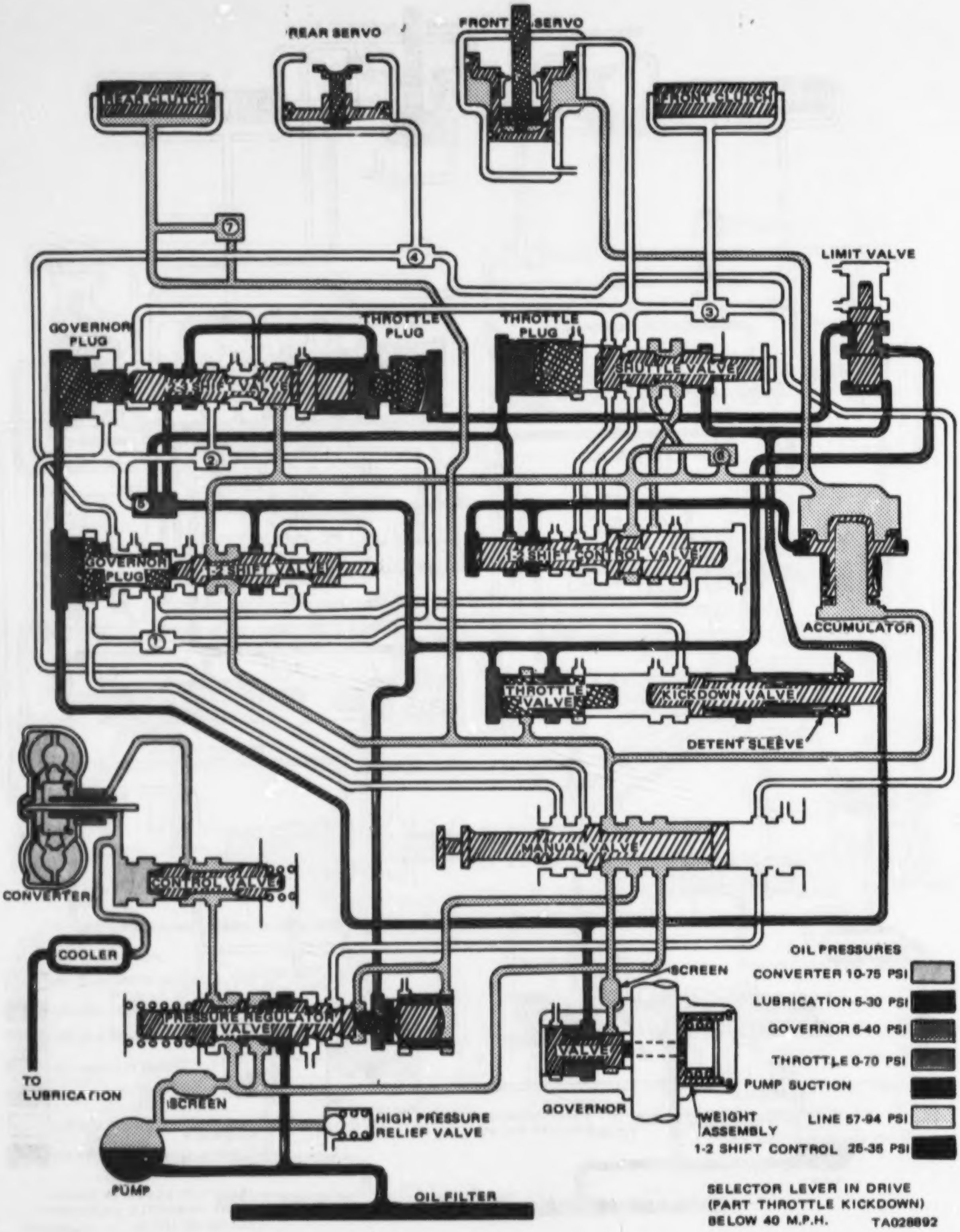

REAR SERVO
FRONT SERVO
REAR CLUTCH
FRONT CLUTCH
7
4
3
LIMIT VALVE
GOVERNOR PLUG
THROTTLE PLUG
2-3 SHIFT VALVE
THROTTLE PLUG
SHUTTLE VALVE
2
6
5
1-2 SHIFT CONTROL VALVE
GOVERNOR PLUG
1-2 SHIFT VALVE
ACCUMULATOR
1
THROTTLE VALVE
KICKDOWN VALVE
DETENT SLEEVE
CONVERTER
CONTROL VALVE
MANUAL VALVE
COOLER
TO LUBRICATION
PRESSURE REGULATOR VALVE
SCREEN
SCREEN
VALVE
GOVERNOR
WEIGHT ASSEMBLY
HIGH PRESSURE RELIEF VALVE
PUMP
OIL FILTER
OIL PRESSURES
CONVERTER 10-75 PSI
LUBRICATION 5-30 PSI
GOVERNOR 6-40 PSI
THROTTLE 0-70 PSI
PUMP SUCTION
LINE 57-94 PSI
1-2 SHIFT CONTROL 25-35 PSI
SELECTOR LEVER IN DRIVE (PART THROTTLE KICKDOWN) BELOW 40 M.P.H.
TA028892

Figure 4-4. Drive–Direct.

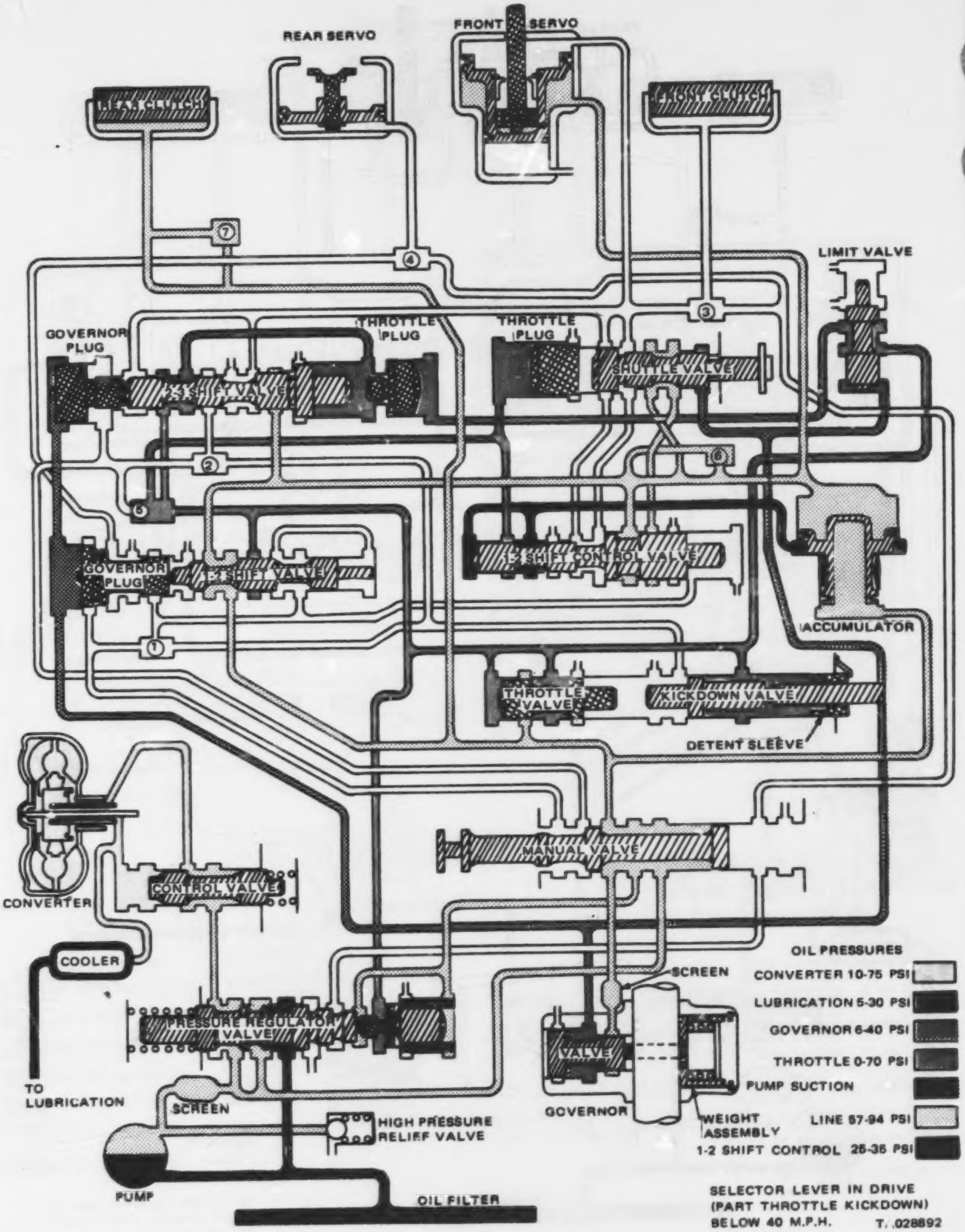

REAR SERVO
FRONT SERVO
REAR CLUTCH
FRONT CLUTCH
LIMIT VALVE
GOVERNOR PLUG
THROTTLE PLUG
THROTTLE PLUG
2-3 SHIFT VALVE
SHUTTLE VALVE
1-2 SHIFT CONTROL VALVE
GOVERNOR PLUG
1-2 SHIFT VALVE
ACCUMULATOR
THROTTLE VALVE
KICKDOWN VALVE
DETENT SLEEVE
MANUAL VALVE
CONVERTER
CONTROL VALVE
COOLER
TO LUBRICATION
PRESSURE REGULATOR VALVE
SCREEN
SCREEN
VALVE
GOVERNOR
WEIGHT ASSEMBLY
HIGH PRESSURE RELIEF VALVE
PUMP
OIL FILTER
1
2
3
4
5
6
7
OIL PRESSURES
CONVERTER 10-75 PSI
LUBRICATION 5-30 PSI
GOVERNOR 6-40 PSI
THROTTLE 0-70 PSI
PUMP SUCTION
LINE 57-94 PSI
1-2 SHIFT CONTROL 25-35 PSI
SELECTOR LEVER IN DRIVE
(PART THROTTLE KICKDOWN)
BELOW 40 M.P.H.
T. .028892

Figure 4-5. Drive–Part Throttle Kickdown.

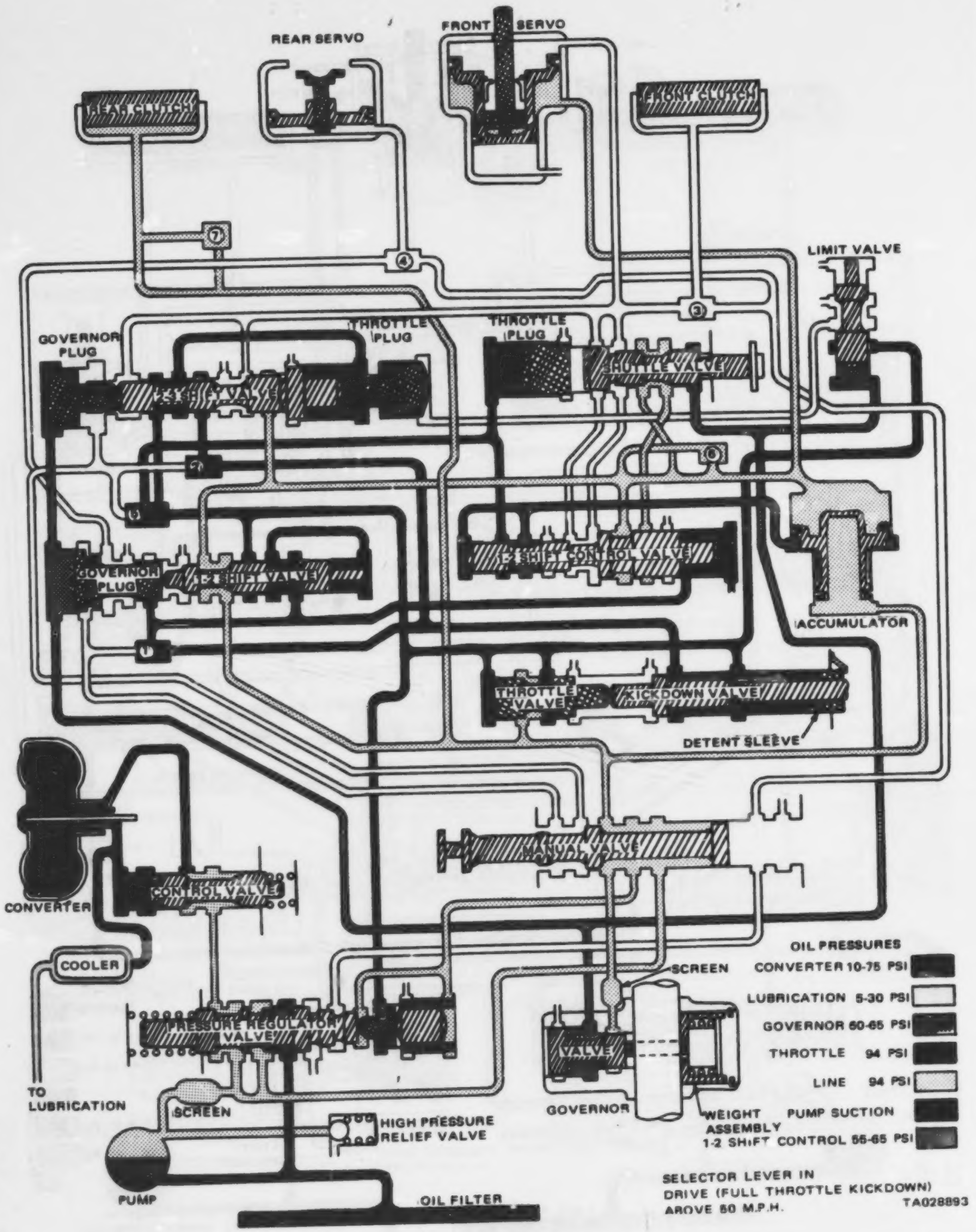

REAR SERVO
FRONT SERVO
REAR CLUTCH
FRONT CLUTCH
⑦
④
③
LIMIT VALVE
GOVERNOR PLUG
THROTTLE PLUG
2-3 SHIFT VALVE
THROTTLE PLUG
SHUTTLE VALVE
②
⑥
⑤
GOVERNOR PLUG
1-2 SHIFT VALVE
1-2 SHIFT CONTROL VALVE
ACCUMULATOR
①
THROTTLE VALVE
KICKDOWN VALVE
DETENT SLEEVE
MANUAL VALVE
CONVERTER
CONTROL VALVE
COOLER
SCREEN
PRESSURE REGULATOR VALVE
VALVE
TO LUBRICATION
SCREEN
HIGH PRESSURE RELIEF VALVE
GOVERNOR
WEIGHT ASSEMBLY
PUMP
OIL FILTER
OIL PRESSURES
CONVERTER 10-75 PSI
LUBRICATION 5-30 PSI
GOVERNOR 60-65 PSI
THROTTLE 94 PSI
LINE 94 PSI
PUMP SUCTION
1-2 SHIFT CONTROL 55-65 PSI
SELECTOR LEVER IN
DRIVE (FULL THROTTLE KICKDOWN)
AROVE 50 M.P.H.
TA028893

Figure 4-6. Drive–Full Throttle Kickdown.

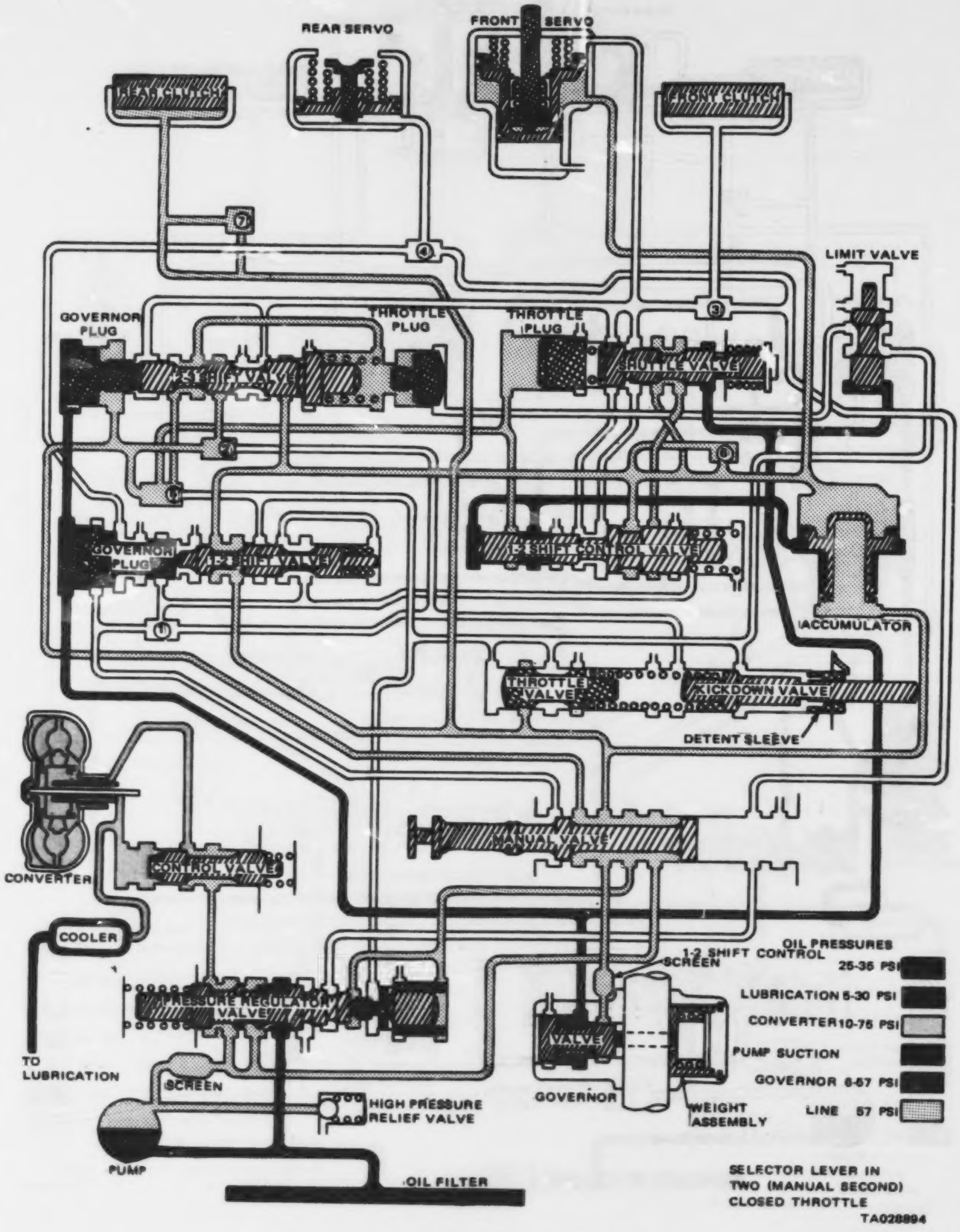

REAR SERVO
FRONT SERVO
REAR CLUTCH
FRONT CLUTCH
7
4
3
LIMIT VALVE
GOVERNOR PLUG
THROTTLE PLUG
THROTTLE PLUG
2-3 SHIFT VALVE
SHUTTLE VALVE
7
1
GOVERNOR PLUG
1-2 SHIFT VALVE
1-2 SHIFT CONTROL VALVE
ACCUMULATOR
THROTTLE VALVE
KICKDOWN VALVE
DETENT SLEEVE
CONVERTER
CONTROL VALVE
MANUAL VALVE
COOLER
PRESSURE REGULATOR VALVE
TO LUBRICATION
SCREEN
PUMP
HIGH PRESSURE RELIEF VALVE
OIL FILTER
1-2 SHIFT CONTROL SCREEN
VALVE
GOVERNOR
WEIGHT ASSEMBLY
OIL PRESSURES
1-2 SHIFT CONTROL 25-35 PSI
LUBRICATION 5-30 PSI
CONVERTER 10-75 PSI
PUMP SUCTION
GOVERNOR 6-57 PSI
LINE 57 PSI
SELECTOR LEVER IN TWO (MANUAL SECOND) CLOSED THROTTLE
TA028894

Figure 4-7. Selector Lever–Two.

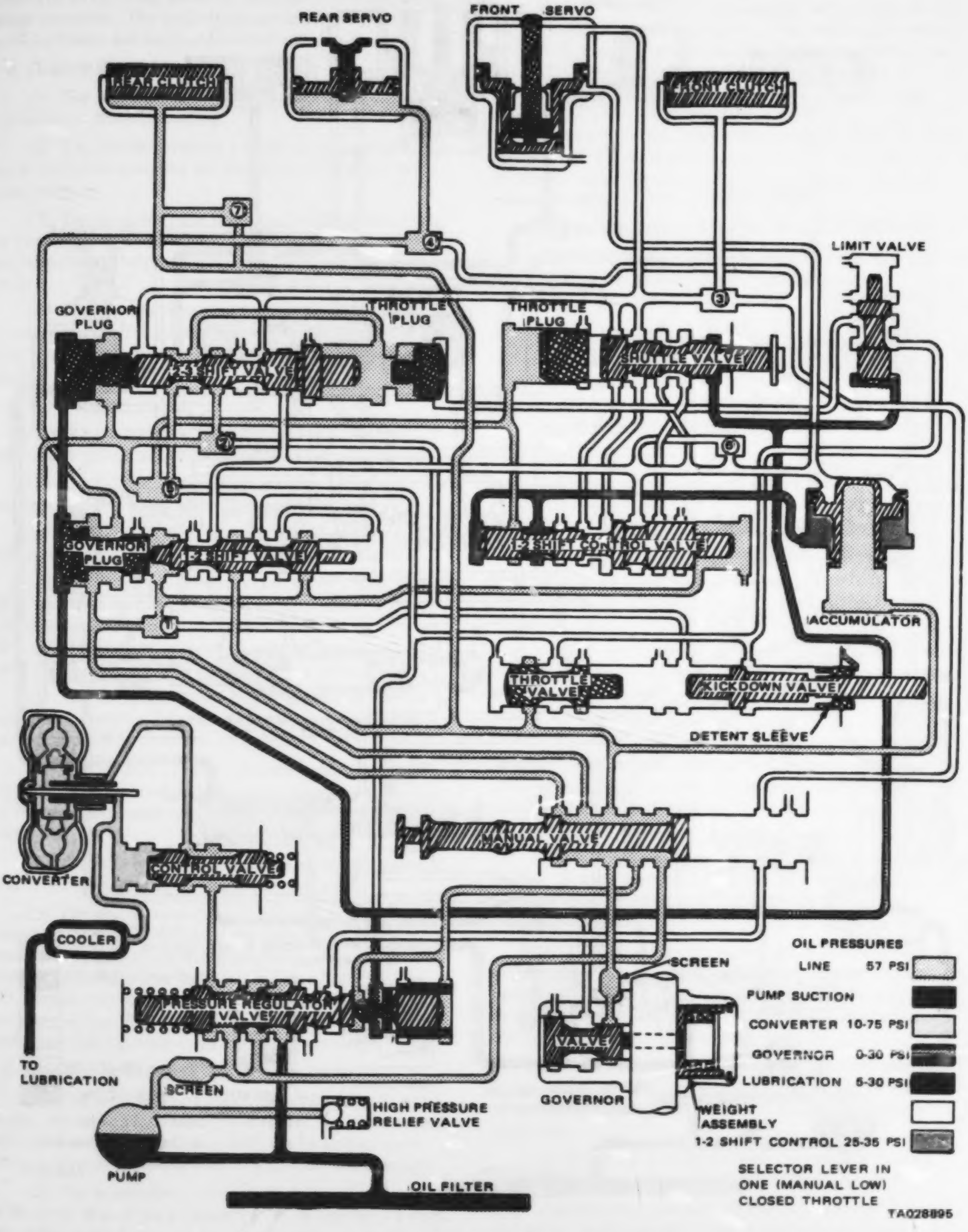

REAR SERVO
FRONT SERVO
REAR CLUTCH
FRONT CLUTCH
7
4
3
LIMIT VALVE
GOVERNOR PLUG
THROTTLE PLUG
THROTTLE PLUG
2-3 SHIFT VALVE
SHUTTLE VALVE
2
5
6
GOVERNOR PLUG
1-2 SHIFT VALVE
1-2 SHIFT CONTROL VALVE
1
ACCUMULATOR
THROTTLE VALVE
KICKDOWN VALVE
DETENT SLEEVE
MANUAL VALVE
CONVERTER
CONTROL VALVE
COOLER
SCREEN
PRESSURE REGULATOR VALVE
TO LUBRICATION
SCREEN
HIGH PRESSURE RELIEF VALVE
PUMP
OIL FILTER
VALVE
GOVERNOR
WEIGHT ASSEMBLY
OIL PRESSURES
LINE 57 PSI
PUMP SUCTION
CONVERTER 10-75 PSI
GOVERNOR 0-30 PSI
LUBRICATION 5-30 PSI
1-2 SHIFT CONTROL 25-35 PSI
SELECTOR LEVER IN ONE (MANUAL LOW) CLOSED THROTTLE
TA028895

Figure 4-8. Selector Lever–One.

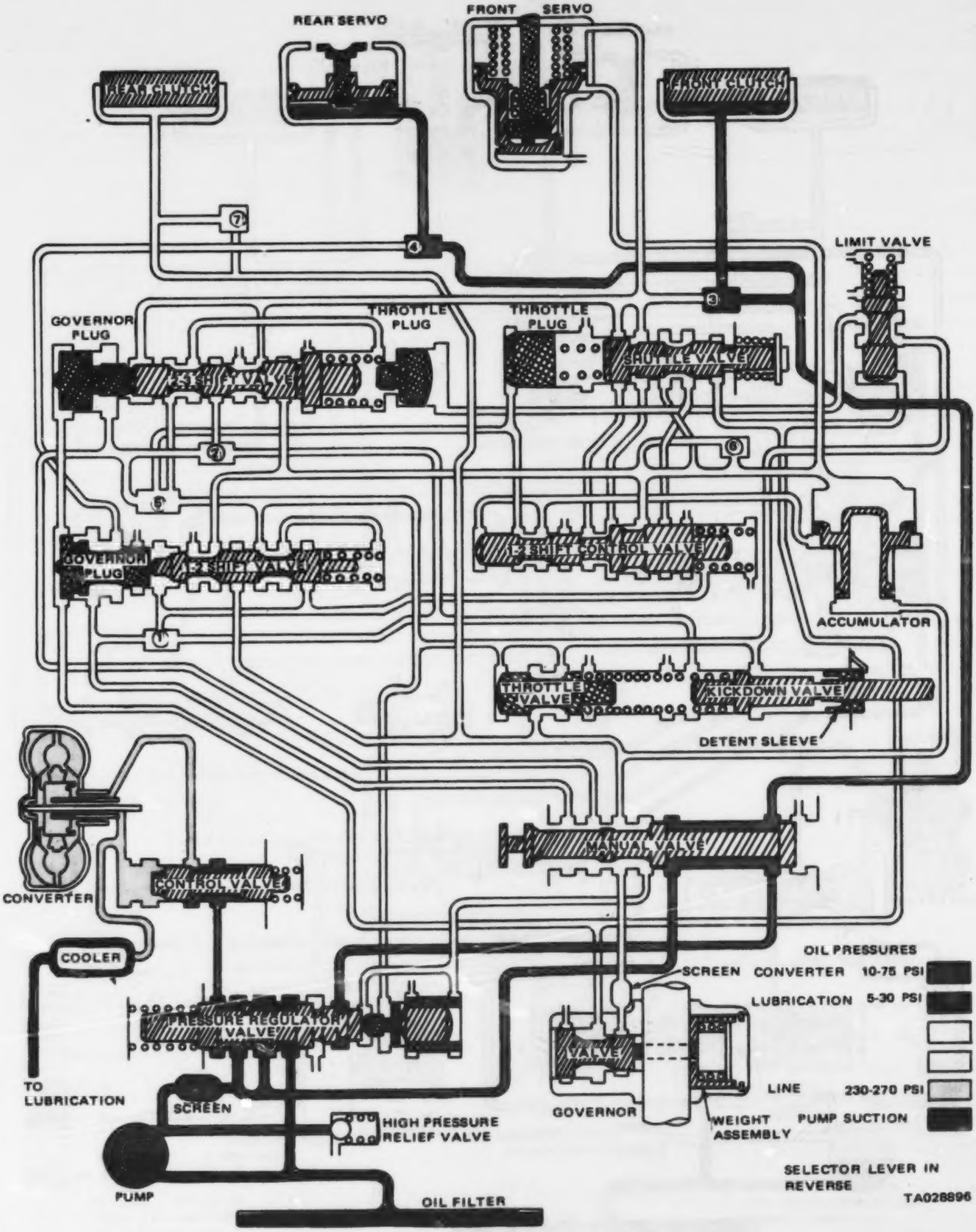

REAR SERVO
FRONT SERVO
REAR CLUTCH
FRONT CLUTCH
7
4
3
LIMIT VALVE
GOVERNOR PLUG
THROTTLE PLUG
2-3 SHIFT VALVE
THROTTLE PLUG
SHUTTLE VALVE
7
6
5
GOVERNOR PLUG
1-2 SHIFT VALVE
1-2 SHIFT CONTROL VALVE
ACCUMULATOR
1
THROTTLE VALVE
KICKDOWN VALVE
DETENT SLEEVE
MANUAL VALVE
CONVERTER
CONTROL VALVE
COOLER
TO LUBRICATION
PRESSURE REGULATOR VALVE
SCREEN
HIGH PRESSURE RELIEF VALVE
PUMP
OIL FILTER
SCREEN
VALVE
GOVERNOR
WEIGHT ASSEMBLY
OIL PRESSURES
CONVERTER 10-75 PSI
LUBRICATION 5-30 PSI
LINE 230-270 PSI
PUMP SUCTION
SELECTOR LEVER IN REVERSE
TA028896

Figure 4-9. Reverse.

a. Pressure Supply System. The pressure supply system consists of an oil pump driven by the engine through the torque converter. The single front pump furnishes pressure for all hydraulic and lubrication requirements.

b. Pressure Control Valves.

(1) The regulator valve controls line pressure at a value dependent on throttle opening.

(2) The torque converter control valve maintains torque converter operating pressure and transmission lubricating pressure.

(3) The governor valve transmits regulated pressure to the transmission. The amount of pressure depends upon vehicle speed and helps control upshift and downshift speeds.

(4) The throttle valve transmits regulated pressure to the transmission. The amount of pressure depends upon throttle position and helps control upshift and downshift speeds.

c. Flow Control Valves.

(1) The manual flow valve provides the different transmission drive ranges as selected by the vehicle operator.

(2) The 1-2 shift valve automatically shifts the transmission from low to second or from second to low.

(3) The 2-3 shift valve automatically shifts the transmission from second to direct or from direct to second.

(4) The kickdown valve makes possible a forced downshift from direct to second, second to breakaway, or direct to breakaway. Valve operation depends upon vehicle speed and is initiated by depressing the accelerator pedal past the detent "feel" near the wide open throttle position.

(5) The throttle pressure plug at the end of the 2-3 shift valve, provides a 3-2 downshift with varying throttle openings depending upon vehicle speed.

(6) The 1-2 shift control valve transmits 1-2 shift control pressure to the transmission accumulator piston to control the kickdown band capacity on 1-2 upshifts and 3-2 downshifts.

(7) The limit valve determines the maximum speed at which a 3-2 part-throttle downshift can be made.

(8) The shuttle valve has two separate functions and performs each independently of the other. The first is to provide fast release of the kickdown band, and smooth front clutch engagement when the driver makes a "lift-foot" upshift from second to direct. The second shuttle valve function is to regulate the application of the kickdown servo and band when kicking down from direct to second.

d. Clutches, Band Servos, and Accumulator.

(1) The front and rear clutch pistons, and both servo pistons, are moved hydraulically to engage the clutches and apply the bands. On the 2-3 upshift, the kickdown servo piston is released by spring tension and hydraulic pressure.

(2) The accumulator controls the hydraulic pressure on the apply side of the kickdown servo during the 1-2 shift. This cushions the kickdown band application at any throttle position.

4-3. Testing the Transmission.

a. General. Automatic transmission malfunctions can be caused by four general conditions: Poor engine performance improper adjustments, hydraulic malfunctions, and mechanical malfunctions. Begin diagnosing these problems by check ing the fluid level and condition, the gear selector linkage adjustment, and the throttle linkage adjustment. Then perform a road test to determine whether the problem has been corrected or if more testing is necessary. If the problem exists after the preliminary tests and corrections are completed, perform the hydraulic pressure tests.

b. Fluid Level and Condition.

(1) Before removing the dipstick, wipe all dirt from the protective cap and the top of the filler tube.

NOTE

Since the torque converter fills more slowly in the "P" (Park) position, place the selector lever in "N" (Neutral) to be sure that the fluid level check is accurate.

(2) Idle the engine. The fluid should be at normal operating temperature (approximately 175° F). Keep the fluid level between the FULL and ADD ONE PINT marks on the dipstick.

(a) Low fluid level can cause a variety of conditions because air mixes with the fluid in the pump. As in any hydraulic system, air bubbles make the fluid spongy; therefore, pressures will be low and build up slowly.

(b) Improper filling can raise the fluid level too high. When the transmission has too much fluid, the gears churn up foam, causing the same conditions which occur with a low fluid level.

(c) In either case, the air bubbles can cause overheating, fluid oxidation, and varnish. These conditions interfere with normal valve, clutch, and servo operation. Foaming can also result in fluid escaping from the transmission vent where it may be mistaken for a leak.

(3) Be sure to examine the fluid on the dipstick closely. If there is any doubt about its condition, drain out a sample for a double check. After the fluid has been checked, seat the dipstick fully to seal out water and dirt.

(4) If the fluid smells burned and is contaminated with metal or foreign particles, a complete transmission overhaul may be needed. Before overhauling, try draining the fluid, changing the filter, adjusting the bands, and refilling the transmission (paragraphs 4-9 and 4-12).

(5) If the fluid smells burned, but there is no evidence of contamination, an overhaul is not necessary. In this case, drain the transmission and refill it in accordance with paragraph 4-9.

(6) If the fluid is okay, check the linkages (c and d, below) and then perform the pressure tests (paragraph 4-4).

c. Gear Selector Linkage. Normal operation of the neutral safety switch provides a quick check to confirm proper gear selector linkage adjustment.

(1) Move the selector lever slowly upward until it clicks into the "P" notch in the selector gate. If the starter will operate, the "P" position is correct.

(2) After checking the "P" position, move the selector slowly toward the "N" position until the lever drops at the end of the "N" stop in the selector gate. If the starter will also operate at this point the gear selector linkage is properly adjusted. If adjustment is required, refer to paragraph 4-10.

d. Throttle Linkage. The throttle rod adjustment is very important to proper transmission operation. This adjustment positions a valve which controls shift speed and quality, and part-throttle downshift sensitivity. If the setting is too short, early shifts and slippage between shifts may occur. If the setting is too long, delayed shifts and sensitive part-throttle downshifts can result. In fact, this adjustment is so critical that the use of a throttle lever holding spring is necessary to remove slack in the linkage during adjustment.

e. Road Test.

(1) Prior to performing a road test, be certain that the fluid level and condition, and the control linkage adjustments have been checked and approved.

(2) During the road test, operate the transmission in each position to check for slipping and any variation in shifting. Note whether the shifts are harsh or spongy, and check the speeds where the upshifts and downshifts occur. Approximate shift speeds for the various modes of operation are shown in table 4-2.

(3) Observe the vehicle closely for transmission slippage. Slipping in any gear usually indicates clutch, band, or overrunning clutch problems. If the condition is far advanced, an overhaul will probably be necessary to restore normal operation.

(4) In most cases, the clutch or band that is slipping can be determined by noting transmission operation in all selector positions, and by comparing which internal units are applied in those positions. Table 4-2 provides a basis for road test analysis.

(a) The rear clutch is applied in both the "D" first gear and "1" first gear positions. The overrunning clutch is applied in "D" first and the low and reverse band is applied in "1" first. If the transmission slips in "D" range first gear but does not slip in "1" first gear, the overrunning clutch is the unit that is slipping. Similarly, if the transmission slips in any two forward gears, the rear clutch is the slipping unit.

(b) Using the same procedure, both the rear and front clutches are applied in "D" third gear. If the transmission slips in third gear, either the front or rear clutch is slipping. The slipping unit is determined by selecting another gear which does not use one of those units. If the transmission also slips in "R" (Reverse), the front clutch is slipping. If it does not slip in "R", the rear clutch is slipping.

(c) Use this process of elimination to detect a slipping unit, and to confirm proper operation of good units. However, although road test analysis can usually diagnose slipping units, the actual cause of the malfunction usually cannot be decided. Practically any condition can be caused by leaking hydraulic circuits or sticking valves.

Table 4-2. Automatic Shift Speeds and Governor Pressure Chart (Approximate MPH)

Axle Ratio: 4.10:1 **Tire Size: 9.50R16.5D**

Condition	MPH
Throttle closed	
1-2 upshift	8-10
2-3 upshift	11-13
3-1 downshift*	7-9
Throttle wide open	
1-2 upshift	23-31
2-3 upshift	49-56
Kickdown range	
3-2 downshift	42-51
3-1 downshift	20-23
Governor pressure	
15 psi	15-18
50 psi	36-39
75 psi	50-54

*Governor pressure should be from zero to 1.5 psi at stand-still or downshift may not occur.

(d) Unless the condition is obvious, like no drive in the "D" range first gear only, never disassemble the transmission until hydraulic pressure tests have been performed.

4-4. Hydraulic Pressure Tests.

a. General. Pressure testing is a very important step in the diagnostic procedure. These tests usually reveal the caus of most transmission problems. Before performing pressure tests, be sure that the fluid level and condition and the linkage adjustments have been checked. Fluid must be at operating temperature.

NOTE

> Do not let the truck move while the transmission is operating during these tests. On 4X4 models, put the transfer in neutral. On 4X2 models, chock the front wheels, raise the rear wheels, and remove any foreign objects from the tires.

b. Preparation for Testing.

(1) Install an engine tachometer so it can be read under the vehicle.

(2) Disconnect the throttle rod and shift it from the transmission levers so they can be controlled under the vehicle.

(3) Attach a 100 psi gage to the ports required for the test being conducted. A 300 psi gage is required for a "reverse" pressure test at the rear servo. Test port locations are shown in figures 4-10 and 4-11.

c. Test One (Selector in "1").

(1) Attach the gages to the line and rear servo ports.

(2) Operate the engine at 1,000 rpm.

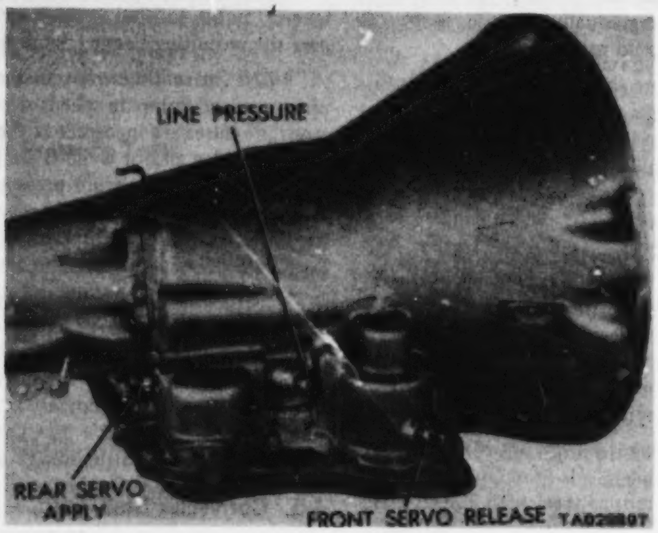

LINE PRESSURE
REAR SERVO APPLY
FRONT SERVO RELEASE

Figure 4-10. Pressure Test Locations (Right Side of Case).

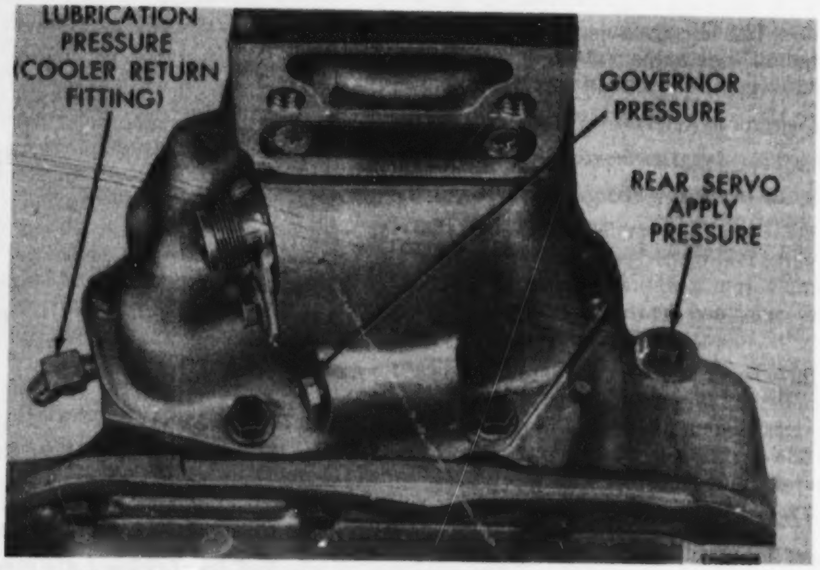

LUBRICATION PRESSURE (COOLER RETURN FITTING)
GOVERNOR PRESSURE
REAR SERVO APPLY PRESSURE

Figure 4-11. Pressure Test Locations (Rear End of Case).

(3) Move the selector lever on the transmission all the way forward (to the "1" position).

(4) Read the pressures on both gages as the throttle lever on the transmission is moved from the full forward position to the full rearward position.

(5) The line pressure should read 54 to 60 psi with the throttle lever forward. It should gradually increase, as the lever is moved rearward, to 90 to 96 psi.

(6) The rear servo pressure should read within 3 psi of the line pressure. This tests the pump output, pressure regulation, and the condition of the rear clutch and the rear servo hydraulic circuits.

d. Test Two (Selector In "2").

(1) Attach a 100 psi gage to the line pressure port, and fit a "T" into the rear cooler line fitting to read the lubrication pressure.

(2) Operate the engine at 1,000 rpm.

(3) Move the selector lever on the transmission one detent back from the full forward position ("2" position).

(4) Read the pressures on both gages as the throttle lever on the transmission is moved from the full forward position to the full rearward position.

(5) The line pressure should read 54 to 60 psi with the throttle lever forward and should gradually increase, as the lever is moved rearward, to 90 to 96 psi.

(6) The lubrication pressure should be 5 to 15 psi with the lever forward, and 10 to 30 psi with the lever rearward. This tests the pump output, pressure regulation, and the condition of the rear clutch and the lubrication hydraulic circuits.

e. Test Three (Selector in "D").

(1) Attach a 100 psi gage to the line and front servo release ports.

(2) Operate the engine at 1,000 rpm.

(3) Move the selector lever on the transmission two detents back from the full forward position ("D" position).

(4) Read the pressures on both gages as the throttle lever on the transmission is moved from the full forward position to the full rearward position.

(5) The line pressure should read 54 to 60 psi with the throttle lever forward, and should gradually increase as the lever is moved rearward, to 90 to 96 psi.

(6) The front servo release is pressurized only in direct drive and should be within 3 psi of the line pressure, up to the downshift point. This tests the pump output, pressure regulation, and the condition of the rear clutch and the front clutch hydraulic circuits.

f. Test Four (Selector in Reverse).

(1) Attach a 300 psi gage to the rear servo apply port.

(2) Operate the engine at 1,600 rpm.

(3) Move the selector lever on the transmission four detents back from the full forward position ("R" position). This tests the pump output, pressure regulation, and the condition of the front clutch and the rear servo hydraulic circuits.

(4) Move the selector lever on the transmission two detents back from the full forward position ("D" position), to check that the rear servo pressure drops to zero. This tests for leakage into the rear servo, caused by case porosity, which in turn causes reverse band burn out.

g. Test Result Indications.

(1) If proper line pressure, minimum to maximum, is found in any one test, the pump and pressure regulator are working properly.

(2) Low pressure in "D," "1," and "2," but correct pressure in "R" indicates a rear clutch circuit leakage.

(3) Low pressure in "D" and "R," but correct pressure in "1" indicates a front clutch circuit leakage.

(4) Low pressure in "R" and "1," but correct pressure in "2" indicates a rear servo circuit leakage.

(5) Low line pressure in all positions indicates a defective pump, a clogged filter, or a stuck pressure regulator valve.

h. Governor Pressure. Test this only if the transmission shifts at the wrong vehicle speeds when the throttle rod is correctly adjusted.

(1) Connect a 100 psi gage to the governor pressure take-off point, located at the lower left side of the extension near the mounting flange (figure 4-11).

(2) Operate the transmission in third gear to read the pressures, and compare speeds shown in table 4-2. If governor pressures are incorrect at the given vehicle speeds, the governor valve and/or weights are probably sticking (see chapter 18). The governor pressure should respond smoothl to changes in mph and should return to 0 to 1-1/2 psi when the vehicle is stopped. High pressure at standstill (above 2 psi) will prevent the transmission from downshifting.

i. Throttle Pressure. No gage port is provided for the throttle pressure. If part-throttle upshift speeds are delayed or occur too early in relation to vehicle speeds, you have incorrect throttle pressure. Engine runaway on either upshifts or downshifts can also indicate incorrect (low) throttle pressure setting. The throttle pressure must not be adjusted unti the transmission throttle linkage adjustment is correct.

4-5. Converter Stall Test.

WARNING

> During the test, don't let anyone stand in front of the vehicle. If the brakes fail or are released, the truck will move forward.

The stall test determines the engine speed at full throttle in the "D" position. This test checks the torque converter stator clutch operation, and the holding ability of the transmission clutches. Check the transmission oil level and bring the engine to normal operating temperature before the stall operation. Both the parking and service brakes must be full applied, and the front wheels blocked while making this test Do not hold the throttle open any longer than is necessary t get a maximum engine speed reading, and never longer than 5 seconds at a time. If more than one stall check is required, operate the engine at approximately 1,000 rpm in Neutral to cool the transmission fluid between runs. If the engine speed exceeds the maximum limits, it indicates transmission clutch slippage; release the accelerator immediately.

a. Stall Speed Above 2,150 rpm. If the stall speed exceeds 2,150 rpm, transmission clutch slippage is indicated. Follow the transmission oil pressure and air pressure checks outlined in paragraph 4-6 to determine the cause of slippage

b. Stall Speed Below 1,450 rpm. Low stall speeds with a properly tuned engine indicate torque converter stator clutc problems. A road test will be necessary to identify the exact problem.

(1) If the stall speeds are below 1,450 rpm, and the vehicle operates properly at highway speeds, but has poor through-gear acceleration, the stator overrunning clutch is slipping. Replace the torque converter.

(2) If the stall speed and acceleration are normal, but abnormally high throttle opening is required to maintain highway speeds, the stator clutch has seized. Replace the torque converter.

c. Noise. A whining or siren-like noise due to fluid flow is normal during stall operation with some converters. However, loud metallic noises from loose parts or interference within the assembly indicate a defective torque converter. Have an assistant operate the vehicle at light throttle in "D" and "N" on jack stands, and listen under the transmission bell housing to confirm any noise originating in the converter.

4-6. Clutch and Servo Air Pressure Tests.

A "no drive" condition might exist even with correct fluid pressure, because of inoperative clutches or servo bands. The inoperative units can be located through a series of tests which substitute air pressure for fluid pressure (figure 4-12). The front and rear clutches, kickdown servo, and the low-reverse servo may be tested by applying air pressure to their respective passages after the valve body assembly has been removed. To make air pressure tests, follow the procedures below.

CAUTION

Compressed air supply must be free of all dirt and moisture. Do not exceed 30 psi.

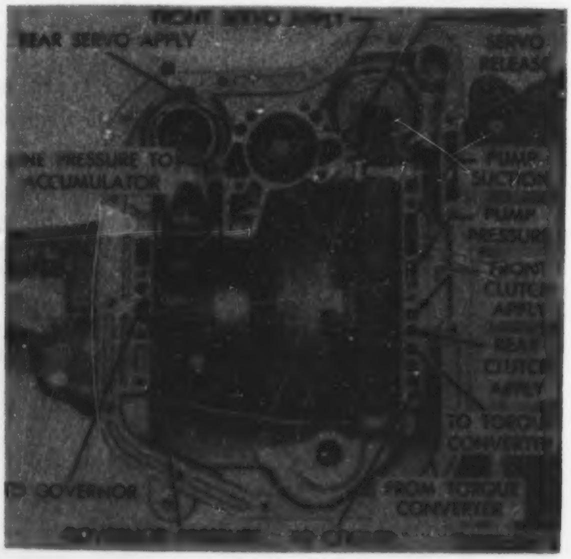


Figure 4-12. Air Pressure Test.

a. Front Clutch. Apply air pressure to the front clutch "apply" passage and listen for a dull thud indicating the front clutch is operating. Hold the air pressure on for a few seconds and inspect the system for excessive oil leaks.

b. Rear Clutch. Apply air pressure to the rear clutch "apply" passage and listen for a dull thud indicating the rear clutch is operating. Also inspect it for excessive oil leaks. If a dull thud cannot be heard in the clutches, place your finger tips on the clutch housing and apply air pressure again. Movement of the piston can be felt as the clutch is applied.

c. Kickdown Servo (Front). Direct air pressure into the front servo "apply" passage. The servo is operating if the front band tightens. Spring tension on the servo piston should release the band.

d. Low and Reverse Servo (Rear). Direct air pressure into the rear servo "apply" passage. The servo is operating if the rear band tightens. Spring tension on the servo piston should release the band. If clutches and servos operate properly, and there is no upshift or erratic shift condition in the transmission, then the valve body is malfunctioning.

4-7. Fluid Leakage—Transmission Converter Housing Area.

a. Check for Source of Leakage. Since fluid leakage at or around the converter area may originate from an engine oil leak, examine the area closely. Transmission fluid is red and, therefore, can be distinguished from engine oil. Prior to removing the transmission, perform the following checks:

(1) When leakage originates from the transmission, check the fluid level and make sure the torque converter drain plug is tight prior to removing the transmission and converter.

(2) High oil level can result in oil leaking out of the vent located at the top of the front pump housing. If the fluid level is high, adjust it to the proper level.

(3) Recheck for leakage. If a leak persists, perform the following operation on the vehicle to determine whether it is the converter or transmission that is leaking.

b. Leakage Test Probe.

(1) Remove the converter housing dust shield.

(2) Position the vehicle with the front lower than the back, so that accumulated fluid in the converter housing will drain out. Wipe the bottom inside of the converter housing as dry as possible. A solvent spray followed by compressed air drying is preferable.

(3) Fabricate a test probe (figure 4-13) and fasten it to a convenient dust shield bolt hole. Make certain the converter is cleared by the test probe. The tool must be clean and dry.

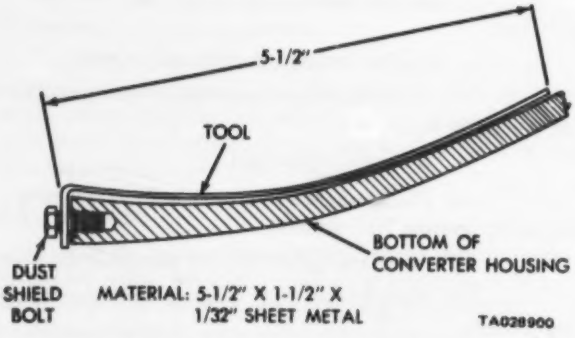
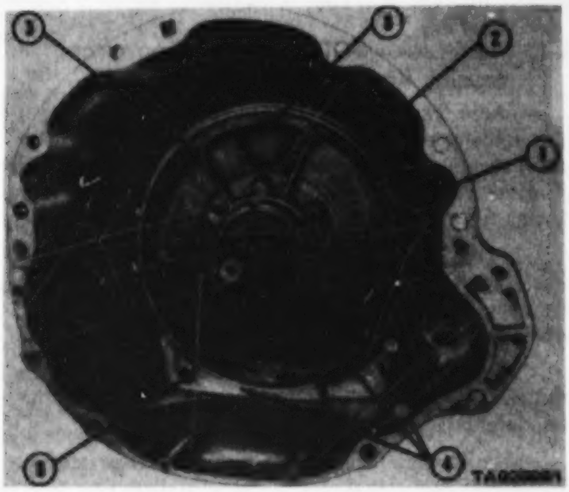

5-1/2"
TOOL
BOTTOM OF CONVERTER HOUSING
DUST SHIELD BOLT
MATERIAL: 5-1/2" X 1-1/2" X 1/32" SHEET METAL
TA028900

Figure 4-13. Leak Locating Test Probe Tool.

(4) Run the engine at approximately 2,500 rpm with the transmission in Neutral, for about 2 minutes. The transmission must be at operating temperature.

(5) Stop the engine and carefully remove the tool.

(6) If the upper surface of the test probe is dry, there is no converter leak. A path of fluid across the probe indicates a converter leak. Oil leaking under the probe is coming from the transmission converter area (figure 4-14).


3
6
2
5
1
4
TA028801

Legend for Figure 4-14:
1. Converter hub seal
2. "O" ring seal
3. Front pump-to-case bolts
4. Case or front pump housing
5. Vent
6. Kickdown lever shaft access plug

Figure 4-14. Transmission Converter Area.

(7) Drain the fluid from the transmission and converter. Reinstall the converter drain plug and the oil pan (with a new pan gasket). Remove the transmission and the torque converter assembly from the truck and install it in a test stand for further investigation.

(8) Possible sources of transmission converter area fluid leakage shown in figure 4-14 are:

(a) Converter hub seal.

1. The seal lip is cut. Check the converter hub finish.

2. The bushing is moved and/or worn.

3. The oil return hold in the front pump housing is plugged or omitted.

4. A seal is worn out.

(b) Fluid leakage at the outside diameter from the pump housing "O" ring seal.

(c) Fluid leakage at the front pump-to-case bolts.

(d) Fluid leakage due to case or front pump housing porosity.

(e) Fluid leakage from the vent.

(f) Kickdown lever shaft access plug.

c. Converter Leakage. Refer to figure 4-15. Possible sources of converter leakage are:

(1) The torque converter weld leaks at the outside diameter (peripheral) weld.

(2) The front pump hub weld.

(3) The crankshaft pilot weld.

(4) Fluid leakage from the converter drain plug. These leaks appear at the outside diameter of the converter on the engine side.

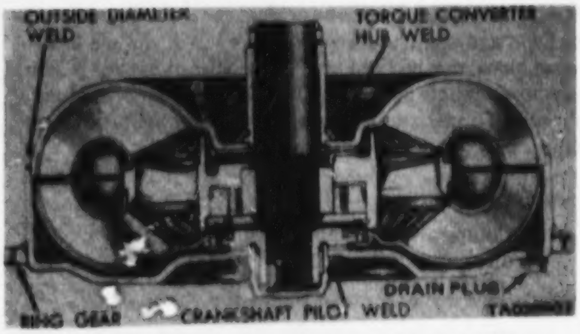

OUTSIDE DIAMETER WELD
TORQUE CONVERTER HUB WELD
DRAIN PLUG
RING GEAR
CRANKSHAFT PILOT WELD

Figure 4-15. Torque Converter Cross Section.

d. Air Pressure Test of Transmission. The equipment needed for the test is shown in figures 4-16, 4-17, and 4-18. After removing the torque converter, prepare the transmission for the pressure test as follows:

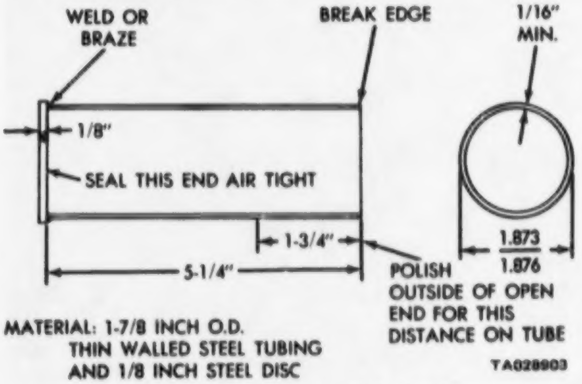

WELD OR BRAZE
BREAK EDGE
1/16" MIN.
1/8"
SEAL THIS END AIR TIGHT
1-3/4"
5-1/4"
1.873
1.876
POLISH OUTSIDE OF OPEN END FOR THIS DISTANCE ON TUBE
MATERIAL: 1-7/8 INCH O.D. THIN WALLED STEEL TUBING AND 1/8 INCH STEEL DISC
TA028903

Figure 4-16. Converter Hub Seal Cup.

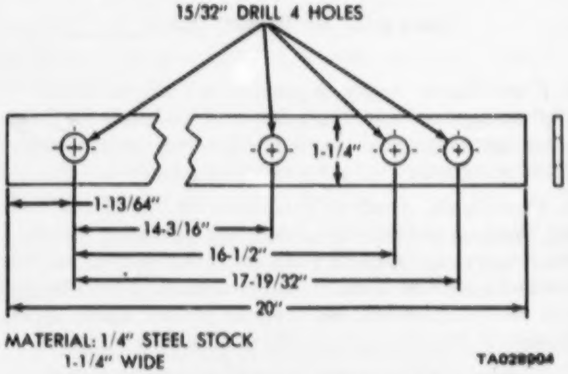

15/32" DRILL 4 HOLES
1-1/4"
1-13/64"
14-3/16"
16-1/2"
17-19/32"
20"
MATERIAL: 1/4" STEEL STOCK 1-1/4" WIDE
TA028904

Figure 4-17. Hub Seal Cup Retaining Strap.

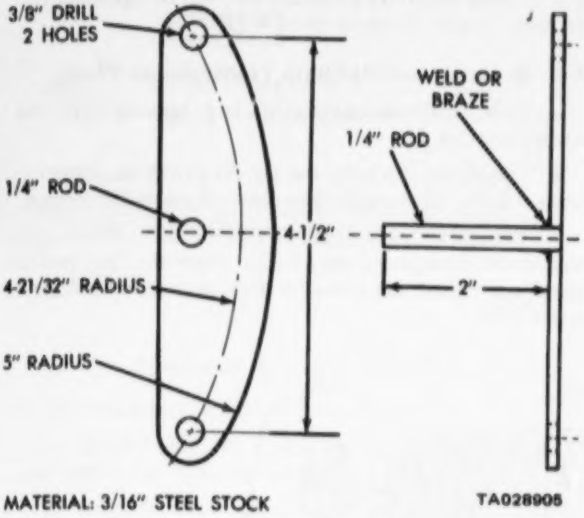


Figure 4-18. Vent Plug Retainer.

(1) Install the filler tube bore plug, the propeller shaft yoke (tie in with cord or wire), the flared tube fitting cap (on front cooler line fitting), and the pipe nipple (in the case at rear cooler line fitting) (figure 4-19).

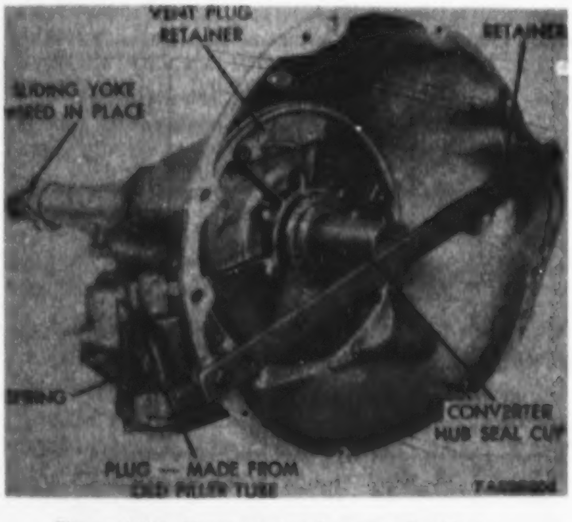


Figure 4-19. Transmission Prepared for Test.

(2) Remove the necessary front pump housing bolts and the vent shield. Install the vent plug (rubber stopper), and the vent plug retainer, preferably using longer bolts than those removed.

(3) With rotary motion, install the converter hub seal cup over the input shaft and through the converter hub seal until the cup bottoms against the pump rotor lugs. Secure it with the cup retainer strap (figure 4-17) using the converter-housing-to-engine-block retaining bolts.

(4) Attach and clamp the air hose nozzle to the pipe nipple, which is in the rear cooler line fitting position in the case (figure 4-20).

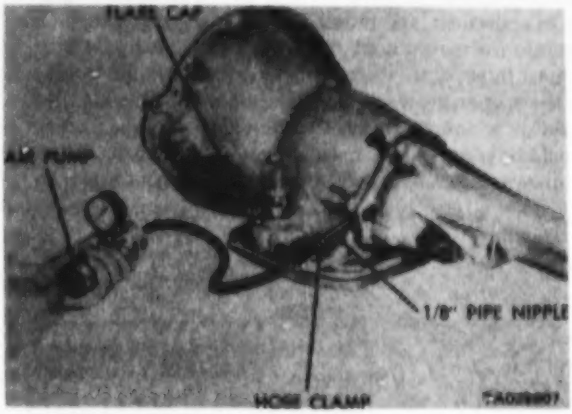


Figure 4-20. Pressurizing the Transmission.

(5) Pressurize the transmission using an appropriate air source until the pressure gage reads 8 psi. Cover the pump housing and the case front with a soapy solution or water and look for leaks. If you locate a definite leak source, replace that part and all associated seals and gaskets with new parts. Leaks may also be caused by porosity in the case or pump housing.

CAUTION

Do not, under any circumstances, pressurize a transmission to more than 10 psi.

e. Torque Converter Pressure Test. If fluid leakage occurs in the bell housing area, the torque converter can be leak-checked as follows after removing it from the transmission:

(1) Drain all the oil from the converter. If flushing is required, flush before checking for leakage.

(2) Connect an air hose to the converter and apply a maximum of 100 psi air pressure.

(3) Submerge the converter in a tank of water and observe the hub, ring gear, and seam welds for bubbles. Five to ten minutes may be required for bubbles to develop from small leaks. If no bubbles develop, the welds are not leaking. If leakage occurs, replace the converter.

4-8. Services.

a. General. Various transmission components can be removed for repairs without removing the transmission from the vehicle. The removal, reconditioning, and installation procedures for these components are covered here.

(1) If the transmission is disassembled for any reason, change the fluid.

(2) Adjust the bands and change the filter whenever you change the fluid.

b. Aluminum Thread Repair. Damaged or worn threads in the aluminum transmission case and valve body can be repaired by the use of Heli-Coils or their equivalent. Essentially, this repair consists of drilling out the worn or damaged threads, tapping the hole with a special Heli-Coil tap or equivalent, and installing a Heli-Coil or equivalent insert into the tapped hole. This brings the hole back to its original thread size. Refer to table 4-3 for details. Some thread drag may occur in screwing a bolt into the installed Heli-Coil or equivalent insert. Therefore, a torque reading should be taken of the thread drag with an inch-pound torque wrench, and added to the specified bolt torque, so that all bolts securing a particular part will be tightened to the same torque. Refer to figure 4-21.

4-9. Draining and Refilling Transmission Fluid.

a. Place a drain container with a large opening under the transmission oil pan.

b. Loosen the pan bolts and tap the pan at one corner to break it loose, allowing fluid to drain. Remove the oil pan.

c. Remove the access plate in front of the converter, and remove the drain plug (figure 4-22). Allow the fluid to drain. Install and tighten the converter drain plug and install the access plate.

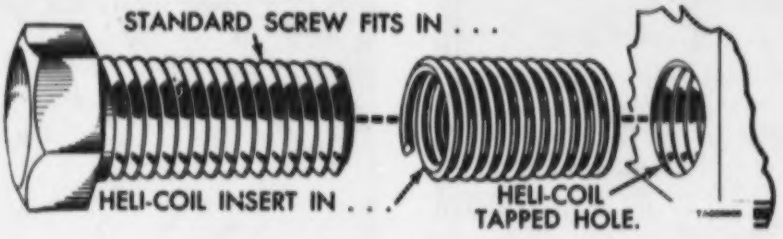


Figure 4-21. Heli-Coil or Equivalent Installation.

Table 4-3. Heli-Coil Chart

Thread size	Mopar part no.	Heli-Coil part no.	Insert length	Drill size	Tap part no. (aluminum)	Tap part no. steel & iron	Inserting tool part no.	Extracting tool part no.
10-24		1185-3CN	9/32"	13/64"	3CPB	1187-3	2288-3	1227-6
1/4-20	5-40	1185-4CN	3/8"	17/64"	4CPB	1187-4	2288-4	1227-6
5/16-18	5-41	1185-5CN	15/32"	21/64"	5CPB	42187-5	2288-5	1227-6
3/8-16	5-42	1185-6CN	9/16"	25/64"	6CPB	42187-6	2288-6	1227-6
7/16-14	5-43	1185-7CN	21/32"	29/64"	7CPB	42187-7	2288-7	1227-16
1/2-13	5-44	1185-8CN	3/4"	33/64"* 17/32"**	8CPB	42187-8	2288-8	1227-16

*In aluminum
**In cast iron or steel

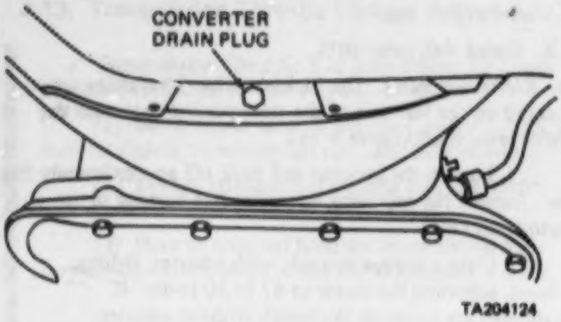

CONVERTER
DRAIN PLUG
TA204124

Figure 4-22. Converter Drain Plug.

d. If necessary, adjust the reverse band.

e. Install a new filter on the bottom of the valve body, and tighten the retaining screws to 35 in-lbs.

f. Clean the oil pan, and reinstall it using a new gasket. Tighten the oil pan bolts to 150 in-lbs.

g. Pour six quarts of "Dexron" type automatic transmission fluid through the filler tube.

h. Start the engine and let it idle for at least 2 minutes. Then, with the parking brake on, move the selector lever momentarily to each position, ending in the neutral position.

i. Add sufficient fluid to bring the level to the ADD ONE PINT mark. Recheck the fluid level after the transmission is at normal operating temperature, making sure the level is between the FULL and ADD ONE PINT marks.

j. To prevent dirt from entering the transmission, make certain that the dipstick cap is fully seated onto the filler tube.

4-10. Gear Selector Linkage Adjustment.

Refer to figure 4-23.

a. Assemble all linkage parts leaving the adjustable rod end free.

b. Place the gear selector lever in "P."

c. Move the selector control lever on the transmission all the way to the rear (in the "P" detent) (figure 4-24).

d. Set the adjustable rod to the proper length and install it with no load in either direction on the linkage.

e. Check adjustment as follows:

(1) The selector lever must move easily and the different selector positions must be clearly felt.

(2) The detent position must be close enough to gate stops in "N" and "D" to assure that the hand lever will not remain out of the detent position when placed against the gate and then released.

(3) Key start must only occur with the selector lever in the "P" or "N" positions. Tighten the adjustment swivel lock bolt to 125 in-lbs.

4-11. Back-Up Light and Neutral Park Safety Switch.

Refer to figures 4-25 and 4-26.

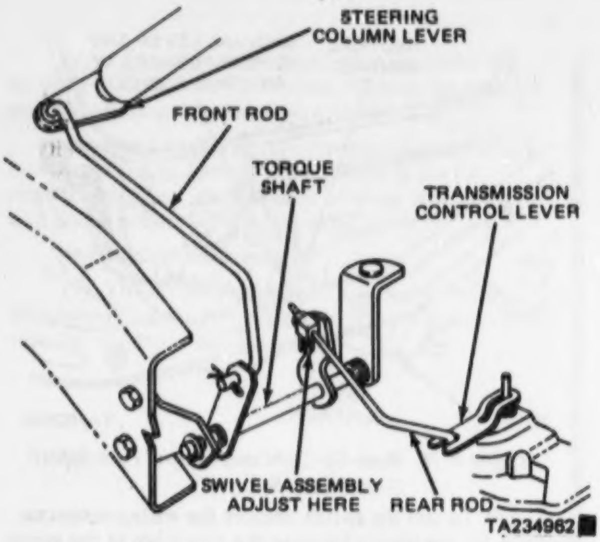

STEERING
COLUMN LEVER
FRONT ROD
TORQUE
SHAFT
TRANSMISSION
CONTROL LEVER
SWIVEL ASSEMBLY
ADJUST HERE
REAR ROD
TA234982

Figure 4-23. Gear Selector Linkage Adjustment.

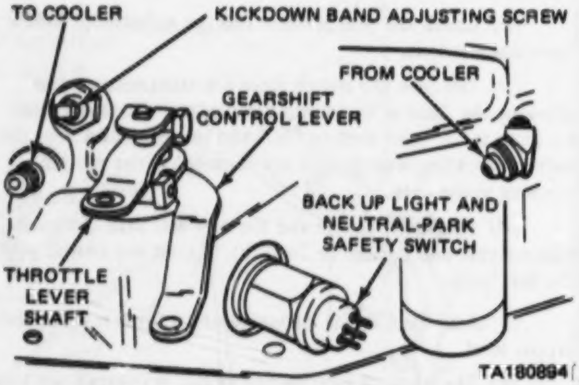

TO COOLER
KICKDOWN BAND ADJUSTING SCREW
FROM COOLER
GEARSHIFT
CONTROL LEVER
BACK UP LIGHT AND
NEUTRAL-PARK
SAFETY SWITCH
THROTTLE
LEVER
SHAFT
TA180894

Figure 4-24. External Controls and Adjustment.

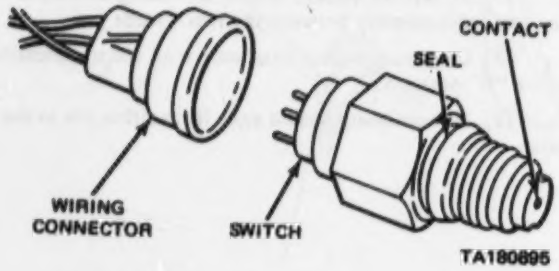

CONTACT
SEAL
WIRING
CONNECTOR
SWITCH
TA180895

Figure 4-25. Back-Up Light and Neutral Park Safety Switch.

a. Replacement and Test. The neutral safety switch is the center terminal of the three-terminal switch. It provides ground for the starter solenoid circuit through the selector lever in only "P" and "N" positions.

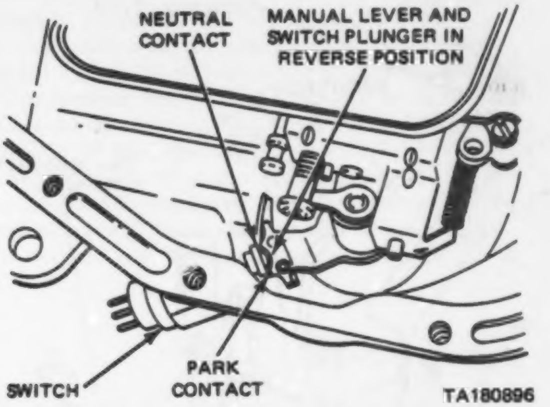


Figure 4-26. Back-Up Light and Neutral Park Safety Switch Installed.

(1) To test the switch, remove the wiring connector and test for continuity between the center pin of the switch and the transmission case. Continuity should exist only when the transmission is in "P" or "N."

(2) Check the gear selector linkage adjustment before replacing a switch.

(3) Unscrew the switch from the transmission case allowing the fluid to drain into a container. Move the selector lever to "P" and then to "N," and inspect to see that the switch operating lever fingers are centered in the switch opening in the case.

(4) Screw the switch and the new seal into the transmission case and tighten to 24 ft-lbs. Retest the switch with the test lamp.

(5) Add fluid to the transmission to bring it up to the proper level.

(6) The back-up light switch circuit is through the two outside terminals of the three-terminal switch.

(7) To test the switch, remove the wiring connector and test for continuity between the two outside pins.

(8) Continuity should exist only with the transmission in the "R" position.

(9) No continuity should exist from either pin to the case.

4-12. Band Adjustments.

a. *Kickdown Band.* The kickdown band adjusting screw is located on the left side of the transmission case near the throttle lever shaft (figure 4-24).

(1) Loosen the locknut and back off approximately five turns. Inspect the adjusting screw for free turning in the transmission case.

(2) Using a torque wrench, with adapter, tighten the band, adjusting the screw to 47 to 50 in-lbs. If adjustments are made on the bench without adapter, tighten the adjusting screw to 72 in-lbs, which is the true torque.

(3) Back off the adjusting screw 2-1/2 turns. Hold the adjusting screw in this position and tighten the locknut to 35 ft-lbs.

b. *Low and Reverse Band.*

(1) Raise the vehicle, drain the transmission fluid, and remove the oil pan.

(2) Loosen the adjusting screw locknut and back off the nut approximately five turns (figure 4-27). Inspect the adjusting screw for free turning in the lever.

(3) Using a torque wrench with adapter, tighten the band adjusting screw to 72 in-lbs.

(4) Back off the adjusting screw two turns. Hold the adjusting screw in this position and tighten the locknut to 30 ft-lbs.

(5) Reinstall the oil pan using a new gasket. Tighten the oil pan bolt to 150 in-lbs.

(6) Fill the transmission with "DEXRON II" type automatic transmission fluid.

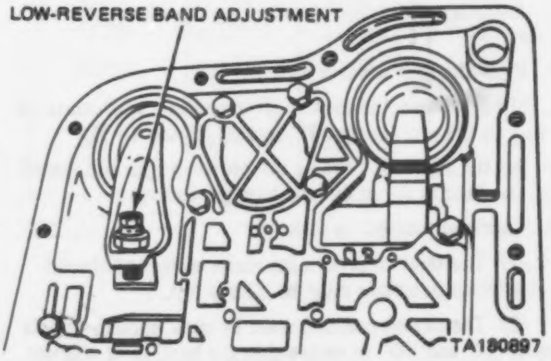


Figure 4-27. Low-Reverse Band Adjustment Screw.

4-13. Transmission Throttle Linkage Adjustment.

a. Transmission Throttle Rod Adjustment for Single-Section Throttle Rod. Refer to figure 4-27.1.

(1) Block choke valve in full open position. Open throttle slightly to release fast idle cam, then release it.

(2) Loosen transmission throttle rod adjustment lock screw.

(3) Have an assistant hold the transmission lever forward, against its stops, while the adjustment is made.

NOTE

It is important that the transmission lever remain firmly against the stop during the next step to insure a correct adjustment.

(4) Adjust the transmission rod at the carburator by pushing forward on the retainer. Tighten the transmission rod adjustment locking screw to 100 in-lbs.

(5) Check the linkage for freedom of operation by moving the slotted link at the carburator to the full rearward position. Then, allow it to return slowly, making sure that it returns to the full forward position.

(6) Unblock the choke.

(7) Visually check the adjustment by noting that the transmission throttle rod begins to move simultaneously with the carburator linkage.

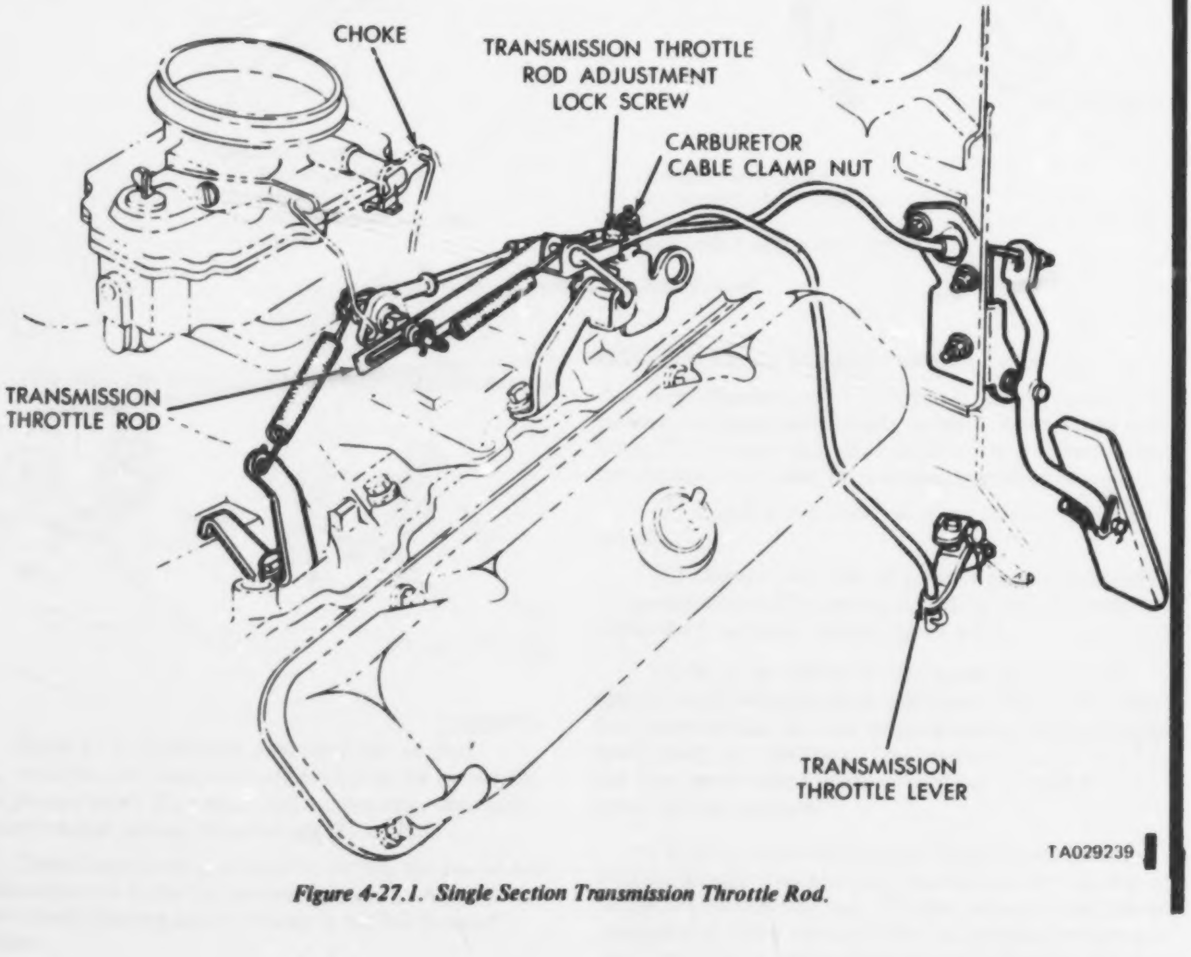

CHOKE
TRANSMISSION THROTTLE ROD ADJUSTMENT LOCK SCREW
CARBURETOR CABLE CLAMP NUT
TRANSMISSION THROTTLE ROD
TRANSMISSION THROTTLE LEVER
TA029239

Figure 4-27.1. Single Section Transmission Throttle Rod.

b. Transmission Throttle Rod Adjustment for Three-Section Throttle Rod. Refer to figure 4-28

(1) Lubricate the linkages.

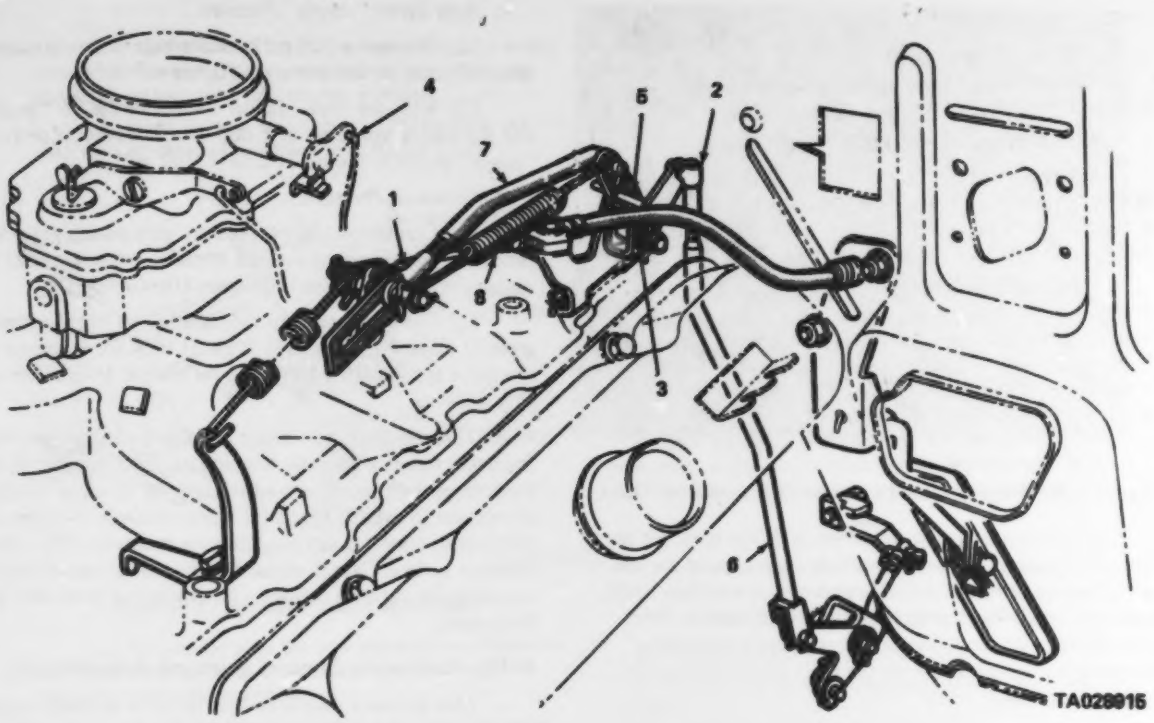
(2) Disconnect the choke (4, figure 4-28) at the carburetor or block the choke valve in the full open position. Open the throttle slightly to release fast idle cam, then return the carburetor to idle.

(3) Have an assistant hold the transmission throttle lever forward against its stop while adjusting the linkage (figure 4-29). Make sure no other force is made against the lower end of the rod. It is important that the transmission lever remain firmly against the stop during the next steps to insure a correct adjustment.

(4) Place a 3/16-inch diameter rod (5, figure 4-28) in the holes provided in the upper bellcrank and lever (3). Adjust the length of the intermediate transmission rod (6) by means of the threaded adjustment at the upper end. The ball socket (2) must line up with the ball end with a slight downward effort on the rod.

(5) Assemble the ball socket (2) to the ball end, and remove the 3/16-inch rod (5) from the upper bellcrank and lever.

(6) Disconnect the return spring (8), clip, and washer. Adjust the length of the carburetor rod (7) by pushing it back with a slight effort (to remove all backlash) and turning the threaded adjustment (1). The rear end of the slot should contact the carburetor lever pin (no backlash) without exerting any forward force on the pin when the slotted adjuster link (1) is in its normal operating position.



Legend for Figure 4-28:
1. Slotted adjuster link
2. Ball socket
3. Upper bellcrank and lever
4. Choke
5. 3/16-inch diameter rod
6. Intermediate transmission rod
7. Carburetor rod
8. Transmission linkage return spring

Figure 4-28. Throttle Rod Adjustment.

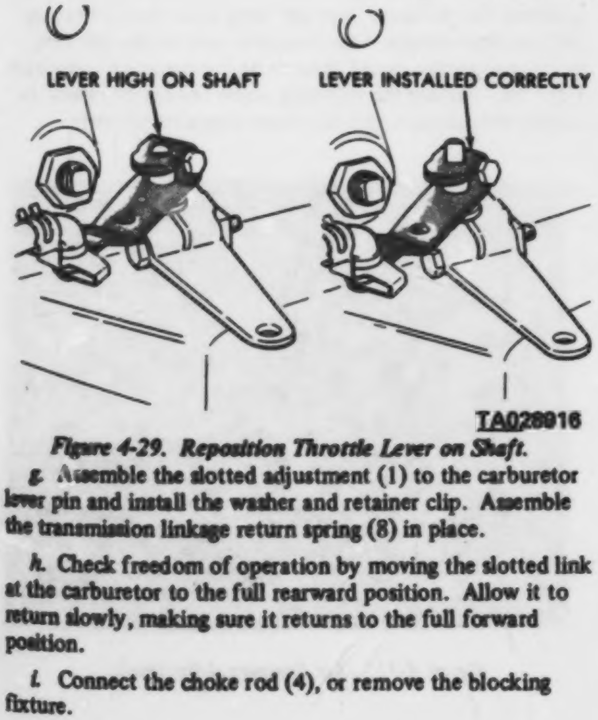


Figure 4-29. Reposition Throttle Lever on Shaft.

g. Assemble the slotted adjustment (1) to the carburetor lever pin and install the washer and retainer clip. Assemble the transmission linkage return spring (8) in place.

h. Check freedom of operation by moving the slotted link at the carburetor to the full rearward position. Allow it to return slowly, making sure it returns to the full forward position.

i. Connect the choke rod (4), or remove the blocking fixture.

4-14. Hydraulic Control Pressure Tests.

a. Line Pressure and Front Servo Release Pressure. Line pressure and front servo release pressure tests must be made in the "D" position with the rear wheels free to turn. The transmission fluid must be at normal operating temperature.

(1) Install a tachometer so it can be read under the vehicle.

(2) Connect two 100 psi pressure gages (minimum) to the pressure take-off points at the side of the accumulator and at the front servo release (figure 4-30).

(3) With the control in "D" speed up the engine slightly until the transmission shifts into direct drive. (The front servo release will then be pressurized.) Reduce engine speed slowly to 1,000 rpm. Line pressure must be 54-60 psi, and front servo release pressure must not be more than 3 psi below the line pressure.

(4) Disconnect the throttle linkage from the transmission throttle lever and move the throttle lever gradually to the full throttle position. The line pressure must rise to a maximum of 90-96 psi just before or at kickdown into low gear. Front servo release pressure must follow the line pressure up to the kickdown point and should not be more than 3 psi below line pressure.

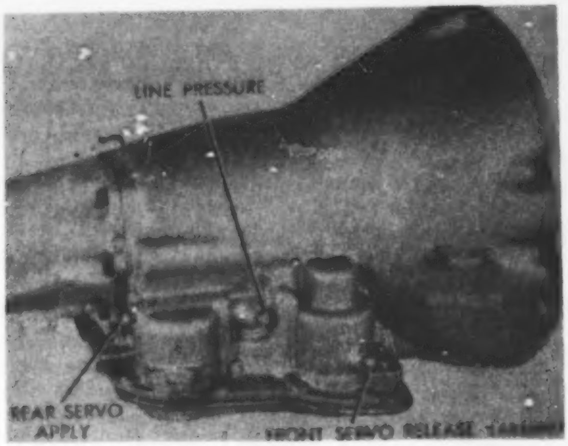


Figure 4-30. Pressure Test Locations (Right Side of Case).

(5) If pressure is not 54-60 psi at 1,000 rpm, see paragraph 4-15, below. If front servo release pressures are less than pressures specified and line pressures are within limits, there is excessive leakage in the front clutch and/or front servo circuits. Always inspect the external transmission throttle lever for looseness on the valve body shaft when making the pressure tests.

b. Fluid Pressure. Test fluid pressure at the same time that you test line pressure and front servo release pressure.

(1) Install a "T" fitting between the cooler return line fitting and the fitting hole in the transmission case at the rear left side of the transmission (figure 4-31). Connect a 100 psi pressure gage to the "T" fitting.

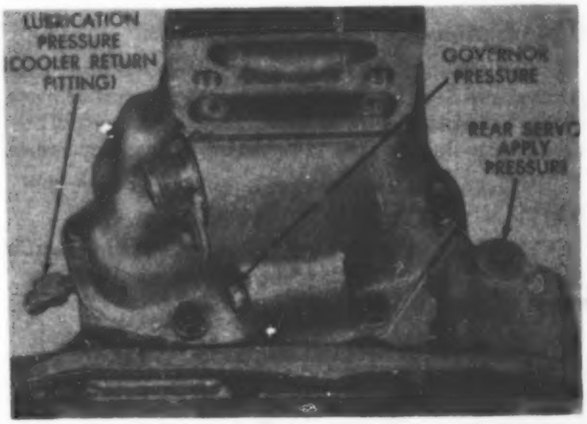

LUBRICATION PRESSURE (COOLER RETURN FITTING)
GOVERNOR PRESSURE
REAR SERVO APPLY PRESSURE

Figure 4-31. Pressure Test Locations (Rear End of Case).

(2) The fluid pressure should be 5-15 psi at 1,000 engine rpm, with the throttle closed and the transmission in direct drive. It will be approximately double when the throttle is opened to maximum line pressure.

c. Rear Servo "Apply" Pressure.

(1) Connect a 300 psi pressure gage to the pressure take-off point at the rear servo (figure 4-31).

(2) With the transmission control in the "R" position and the engine speed set at 1,600 rpm, the reverse servo "apply" pressure should be 230 to 260 psi.

d. Governor Pressure.

(1) Connect a 100 psi pressure gage to the governor pressure take-off point, located at the lower left side of the extension near the mounting flange (figure 4-31).

(2) Governor pressures should fall within the limits given in table 4-2 (paragraph 4-3). If they are incorrect at the given speeds, the governor valve and/or weights are probably sticking.

e. Throttle Pressure. There is no throttle pressure test. Incorrect throttle pressure should only be suspected if part-throttle upshift speeds are either delayed or occur too early in relation to vehicle speeds. Engine runaway on either upshifts or downshifts can also indicate incorrect (low) throttle pressure setting. Never adjust the throttle pressure until the transmission throttle linkage adjustment has been verified to be correct.

4-15. Hydraulic Control Pressure Adjustments.

a. Line Pressure. An incorrect throttle pressure setting will cause incorrect line pressure readings even though the line pressure adjustment is correct. Always inspect and correct the throttle pressure adjustment before adjusting the line pressure. The approximate adjustment is 1-5/16 inches, measured from the valve body to the inner edge of the adjusting nut (figure 4-32). However, due to manufacturing tolerances, the adjustment can be varied to obtain the specified line pressure. The adjusting screw may be turned with an allen wrench. One complete turn of the adjusting screw changes the closed throttle line pressure approximately 1-2/3 psi. Turning the adjusting screw counterclockwise increases the pressure, and clockwise decreases pressure.

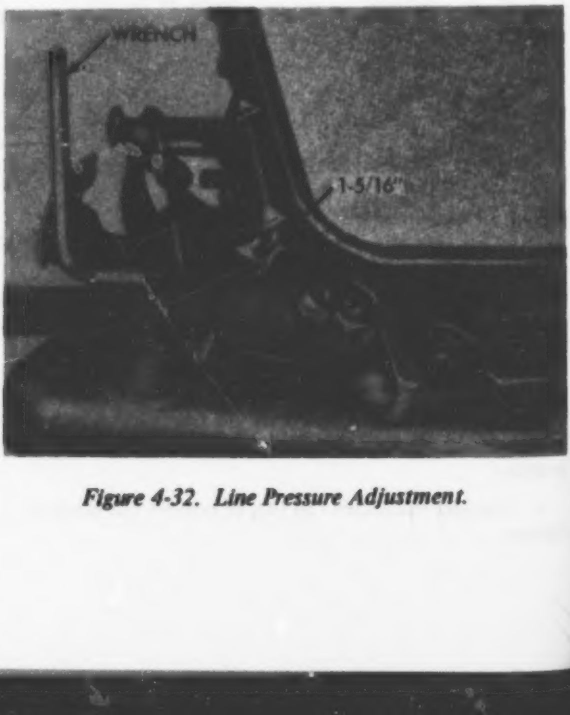


Figure 4-32. Line Pressure Adjustment.

b. Throttle Pressure. Throttle pressures cannot be tested accurately; therefore, the transmission linkage adjustment should be measured if a malfunction is evident.

(1) Insert the gage pin of tool C-3763 between the throttle lever cam and kickdown valve (figure 4-33).

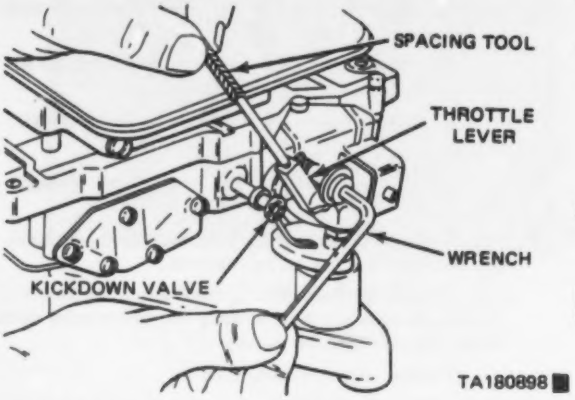


Figure 4-33. Throttle Pressure Adjustment.

(2) By pushing in on the tool, compress the kickdown valve against its spring so the throttle valve is completely bottomed inside the valve body.

(3) As force is being exerted to the compressed spring, turn the throttle lever stop screw with an allen wrench until the head of the screw touches the throttle lever. The throttle lever cam should be touching the tool and the throttle valve should be bottomed. Make the adjustment with the spring fully compressed and the valve bottomed in the valve body.

4-16. Speedometer Drive Pinion Gear Assembly (4X2 Models).

Removal and Installation. Refer to figure 4-34.

a. Remove the bolt and the retainer securing the speedometer pinion adapter in the extension housing.

b. With the cable housing connected, carefully work the adapter and pinion out of the extension housing.

c. Disconnect the cable from the adapter.

d. Place a new adapter into the transmission.

e. Install a clamp and bolt and torque to 100 in-lbs.

f. Reconnect the cable.

4-17. Replacing the Output Shaft Oil Seal (4X2 Models Only).

a. Mark the parts for reassembly. Disconnect the propeller shaft at the rear universal joint. Carefully pull the shaft yoke out of the transmission extension housing.

NOTE

Be careful not to scratch or nick the ground surface on the sliding spline yoke when removing and installing the shaft assembly.

b. Remove the extension housing boot.

c. Remove the extension housing yoke seal with tool C-3985.

Figure 4-35. Deleted.

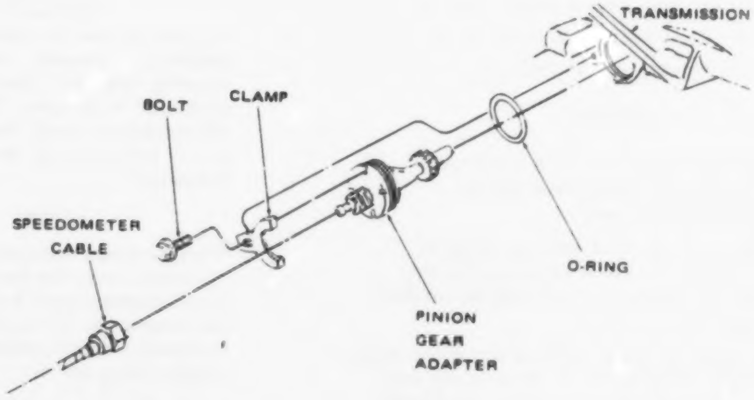


Figure 4-34. Speedometer Drive.

d. To install a new seal, position it in the opening of the extension housing and drive it into the housing with tool C-3972 (figure 4-36).

e. Carefully guide the front universal joint yoke into the extension housing and on the mainshaft splines. Aline the marks made at removal, and connect the propeller shaft to the rear axle pinion shaft yoke.

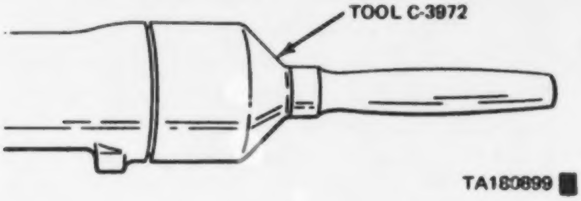


Figure 4-36. Installing Extension Housing Yoke Seal.

4-18. Removing the Transmission and Converter.

NOTE

The transmission and converter must be removed as an assembly; otherwise, the converter drive plate, pump bushing, or oil seal may be damaged. The drive plate will not support a load; therefore, don't rest the transmission on the plate during removal.

a. Disconnect the negative (ground) cable from the battery.

b. Raise truck off the ground to gain access to the transmission.

c. Disconnect the exhaust pipes from the exhaust manifolds.

d. Remove the strut between the engine and transmission.

e. Remove the oil filter.

f. Disconnect the cooler lines at the transmission.

g. Remove the starter and the cooler line bracket.

h. Remove the converter access cover.

NOTE

Drain plug is not installed on late model transmission. On these transmissions drain transmission, only.

i. Rotate the crankshaft clockwise, using a socket wrench on the front of the crankshaft to bring the converter drain plug to the bottom. Then, drain the converter and transmission

j. Mark the converter and the drive plate to aid in reassembly. The crankshaft flange bolt circle, the inner and outer circle of holes in the drive plate, and the four tapped holes in the front face of the converter all have one hole offset so these parts will be installed in the original position. This maintains balance of the engine and converter.

k. Rotate the crankshaft clockwise with a socket wrench on the front of the crankshaft to expose the bolts attaching the torque converter to the drive plate. Remove the bolts in sequence.

l. **Remove the propeller shaft and the insulator engine rear support on 4X2 models. Remove both propeller shafts, transfer, and the center mount on 4X4 models.**

m. Disconnect the wire connector from the back-up light and the neutral safety switch.

n. Disconnect the gear selector rod and the torque shaft assembly from the transmission.

o. Disconnect the throttle rod from the lever at the left side of the transmission.

p. Remove the speedometer cable (4X2 models only).

q. Remove the oil filler tube.

r. Place a wood block under the engine, and support it with a jack.

s. Raise the transmission slightly with the transmission jack to relieve the load on the supports.

t. Remove the bolts securing the transmission mount to the crossmember and those securing the crossmember to the frame. Remove the crossmember.

u. Remove all bell housing bolts.

v. Attach a small "C" clamp to the edge of the bell housing to hold the converter in place during transmission removal.

w. Carefully remove the transmission and the converter as an assembly from the engine block dowels.

x. Lower the transmission and remove the assembly from under the truck.

y. Remove the "C" clamp from the edge of the bell housing.

z. Carefully slide the converter assembly off the transmission shaft.

4-19. Transmission, Converter, and Drive Plate Installation.

CAUTION

The transmission and converter must be installed as an assembly; otherwise, the converter drive plate, pump bushing, and oil seal may be damaged. The drive plate will not support a load. Therefore, never rest the transmission on the plate during installation.

NOTE

When installing a replacement transmission in a vehicle, make sure that the linkage (throttle control lever) is identical to the old transmission. If not, remove the linkage from the old transmission, and install it on the new one.

a. Rotate the pump rotors with tool C-3881 until the two small holes in the handle are vertical (figure 4-37).

Figure 4-37. Alining Pump Rotors.

b. Carefully slide the converter assembly over the input and reaction shafts. Make sure the converter hub slots are also vertical, and fully engage the pump inner rotor lugs. Test for full engagement by placing a straightedge on the face of the case (figure 4-38). The surface of the converter front cover lug should be at least one-half inch behind the straightedge when the converter is pushed all the way into the transmission.

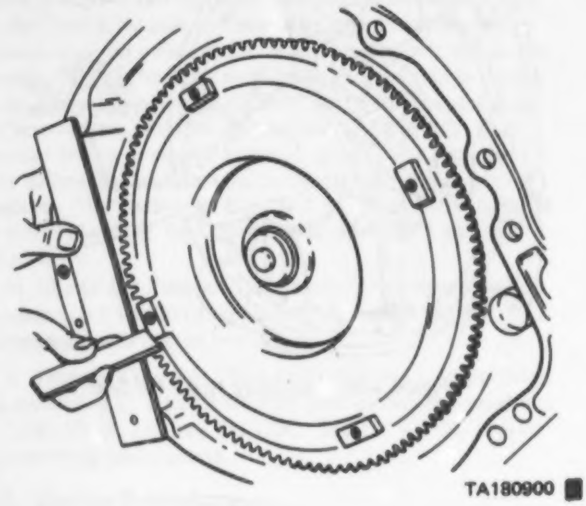


Figure 4-38. Measuring Converter for Full Engagement in Transmission.

c. Attach a small "C" clamp to the edge of the converter housing to hold the converter in place during transmission installation.

d. Inspect the converter drive plate for distortion or cracks and replace it if necessary. Torque the drive plate-to-crankshaft bolts to 55 ft-lbs. When drive plate replacement is necessary, make sure both transmission dowel pins are in the engine block and that they are protruding far enough to hold the transmission in alinement.

e. Coat the converter hub hole in the crankshaft with grease. Place the transmission and converter assembly on a transmission jack, and position the assembly under the truck. Raise or tilt as necessary until the transmission is alined with the engine.

f. Rotate the converter so that the mark made during removal will aline with the mark on the drive plate. The offset holes in the plate are located next to a 1/8-inch hole in the inner circle of the plate. A stamped O mark identifies the offset hole in the converter front cover (figure 4-39). Carefully work the transmission assembly forward over the engine block dowels with the converter hub entering the crankshaft opening.

g. After the transmission is in position, install the converter housing bolts and tighten to 28 ft-lbs.

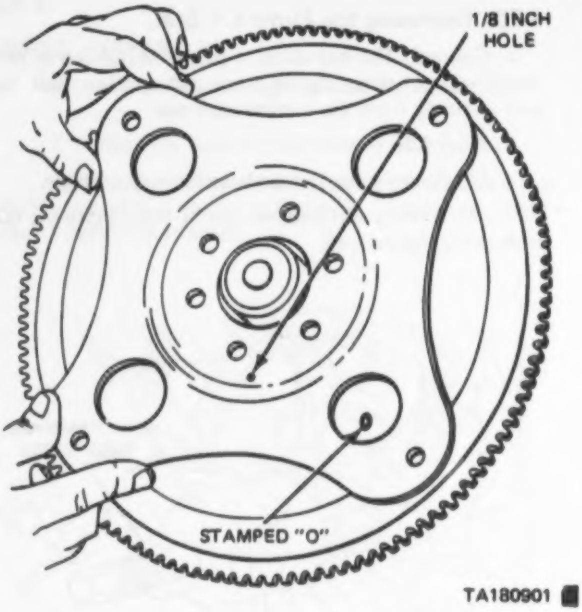


Figure 4-39. Converter and Drive Plate Markings.

h. Install the crossmember to the frame. Lower the transmission to install the mount on the extension to the crossmember.

i. Remove the engine support.

j. Install the oil filler tube and the speedometer cable.

k. Connect the throttle rod to the transmission lever.

l. Connect the gear selector rod and torque shaft assembly to the transmission lever and frame.

m. Place the wire connector on the combination back-up light and neutral/park safety switch.

n. Install the propeller shaft and insulator engine rear support (and transfer on 4X4 models).

o. Rotate the engine clockwise to install the drive plate bolts to the converter. Match the marks made at removal. Tighten to 270 in-lbs.

p. Install the converter access cover.

q. Install the starter and the cooler line bracket.

r. Tighten the cooler lines to the transmission fittings.

s. Install the engine to the transmission strut. Tighten the bolts holding the strut to the transmission first.

t. Adjust the shift and the throttle linkage.

u. If old transmission is reinstalled, install new pan gasket.

v. Refill the transmission.

w. Attach the exhaust pipes to exhaust manifolds with bolts, washers, and nuts.

x. Lower truck.

4-20. Replacing the Pump Oil Seal.

a. General. The transmission pump oil seal can be replaced without removing the pump and reaction shaft support assembly from the transmission case.

b. Procedure.

(1) Remove the transmission from the vehicle.

(2) Screw a seal remover (tool C-3861) into the seal as shown in figure 4-40.

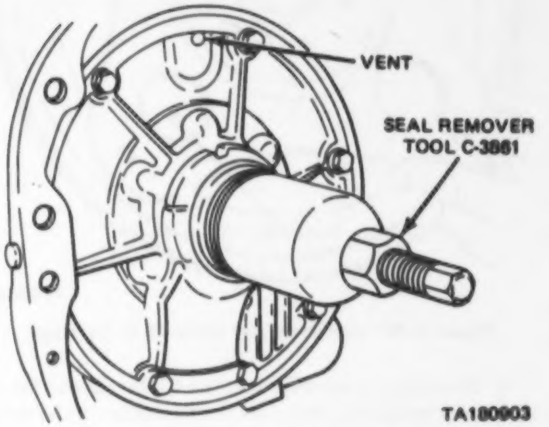

VENT
SEAL REMOVER TOOL C-3861
TA180903

Figure 4-40. Removing Pump Oil Seal.

(3) Apply sealer to the outer diameter of the new seal.

(4) Place a new seal in the opening of the pump housing with its lip facing inward. Use tool C-3860 to drive the seal into the housing until the tool bottoms (figure 4-41).

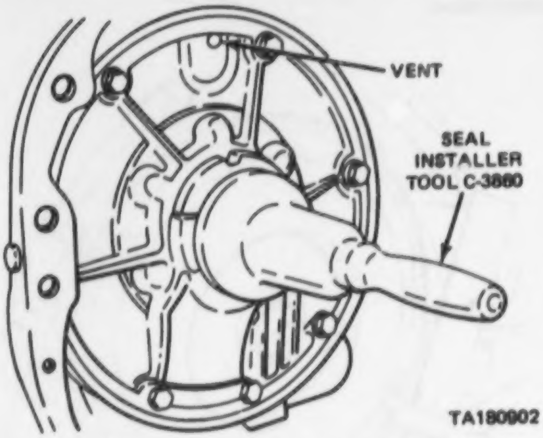

VENT
SEAL INSTALLER TOOL C-3860
TA180902

Figure 4-41. Installing Pump Oil Seal.

CHAPTER 5

REPAIR OF THE TRANSFER ASSEMBLY

5-1. General Information.

a. Description. The transfer assembly provides full-time four-wheel drive. It is a two-speed unit which provides speed reduction and transmits power from the transmission to the front drive axle and rear drive axle by means of two conventional propeller shafts. A differential unit within the transfer case allows front and rear axles to remain in continuous drive while allowing the drive shafts to turn at slightly different speeds with the control lever in HI or LO. This permits driving at normal highway speeds. The transfer case differential is locked out in the HI LOC or LO LOC position. This causes the front and rear drive shafts to move at identical speeds, thus providing positive front and rear wheel drive.

b. HI and LO Ranges. The transfer's two-speed feature consists of a 1:1 ratio (direct drive) high range and a 2.01:1 ratio speed reduction in low range.

c. Transfer Control. The speed range and lock positions are controlled by a single shifting lever having five positions: HI LOC, HI, N, LO, and LO LOC. See TM 9-2320-266-10 for operating instructions.

5-2. Service Procedures.

a. Adjusting the Linkage. Refer to figure 5-1.

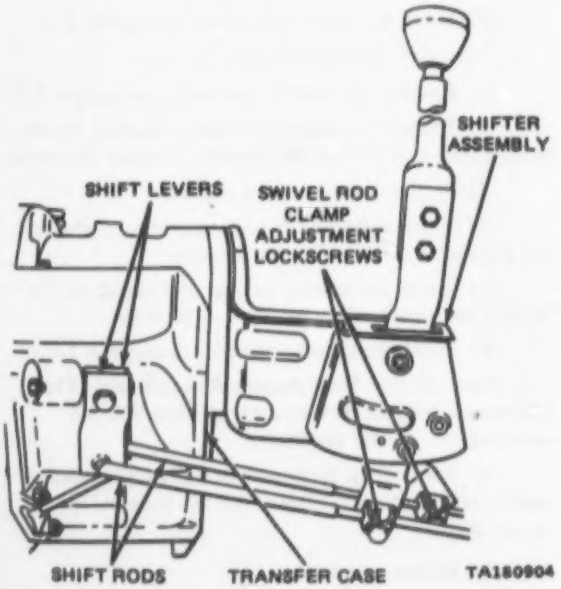

SHIFTER ASSEMBLY
SHIFT LEVERS
SWIVEL ROD CLAMP ADJUSTMENT LOCKSCREWS
SHIFT RODS
TRANSFER CASE
TA180904

Figure 5-1. Shifter Assembly and Linkage.

(1) Place the transfer shift lever in HI.

(2) Loosen both swivel rod clamp lockscrews at the shifter assembly as shown in figure 5-2. Both rods must be free to slide in the swivels.

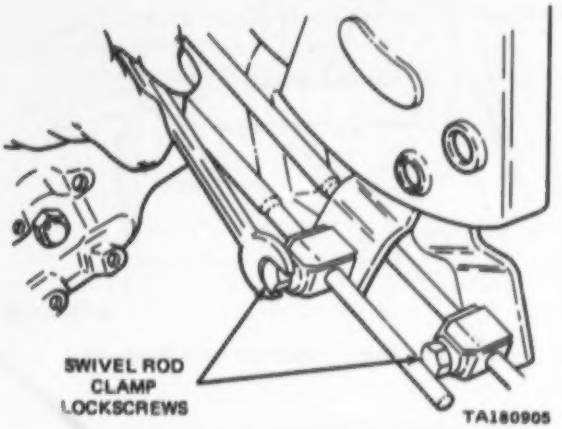

SWIVEL ROD CLAMP LOCKSCREWS
TA180905

Figure 5-2. Loosening the Lockscrews.

(3) Put the transfer shift lever in the cab in "N" and insert an 11/64-inch diameter rod through the alinement holes in the shifting housing (figure 5-3).

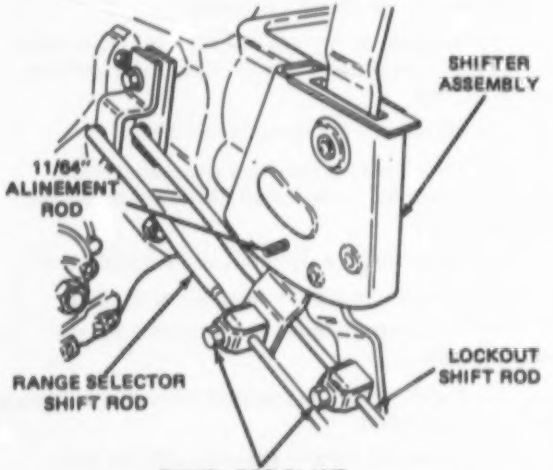

SHIFTER ASSEMBLY
11/64" ALINEMENT ROD
RANGE SELECTOR SHIFT ROD
LOCKOUT SHIFT ROD
SWIVEL ROD CLAMP LOCKSCREWS
TA180906

Figure 5-3. Alinement Rod in Position.

(4) Place the range shift linkage (outside lever) into neutral, keeping the lockout shift lever in unlock, as shown in figure 5-4.

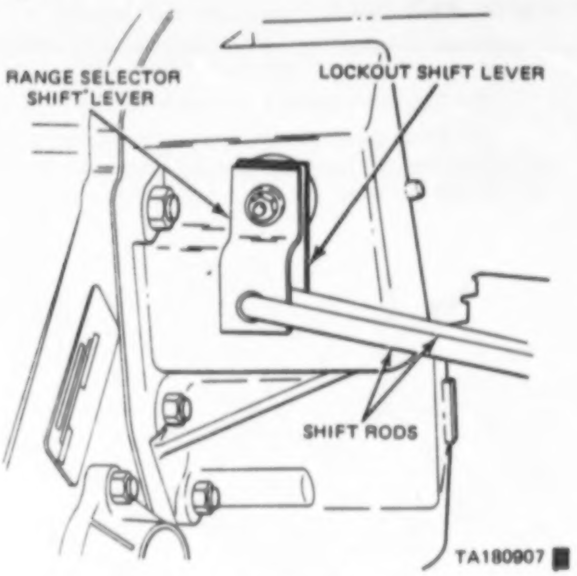


Figure 5-4. Levers Positioned for Adjustment.

(5) Retighten the swivel rod clamp lockscrews to 11 ft-lbs.

(6) Remove the 11/64-inch alinement rod from the shifter housing.

(7) Cycle the transfer shift lever to check for proper operation.

b. Removing the Transfer Assembly.

(1) Remove the bottom bolt from the front output rear cover. Allow the case to drain completely and then replace the bolt.

(2) Disconnect the speedometer cable.

(3) Disconnect the front and rear output shafts from the yokes. Secure each shaft; do not let them hang unsupported.

(4) Disconnect the shift rods at the transfer case.

(5) Support the transfer assembly with a jack.

(6) Remove the transfer to transmission adapter mounting bolts.

(7) Move the transfer assembly rearward to disengage the front input spline.

(8) Lower the transfer assembly with the jack. Remove it from under the vehicle.

c. Installing the Transfer Assembly.

(1) Place the transfer assembly on a jack.

(2) Position the transfer assembly under the truck and aline it with the transmission output shaft. Engage the input spline with the transmission output shaft and install the transfer-to-transmission adapter mounting bolts.

(3) Remove the jack.

(4) Connect the shift rods and speedometer cable.

(5) Connect the front and rear output shafts to the yokes.

5-3. Replacing the Bearing and Seal.

a. Input Gear Bearing.

(1) Remove the transfer assembly (paragraph 5-2).

(2) Remove the bearing retainer screws, retainer, and gasket from the housing. Discard the gasket.

(3) Remove the bearing retaining snap ring from the shaft.

(4) Pry the bearing from the case and remove it from the shaft.

(5) Remove the access hole cover. This provides an opening to inspect the input and countergear assemblies. Check for burrs, scoring, heat discoloration, or other irregularities; replace the transfer assembly if any of these conditions exist.

(6) Install the outer ring into the groove of the new input gear bearing and with a soft hammer, tap it into place in the housing.

(7) Select the service ring size that will provide the tightest fit and install the ring in the bearing retaining groove of the input gear shaft.

(8) Position the new gasket and the bearing retainer on the housing. Install the retaining screws. Tighten to 20 ft-lbs.

(9) Replace the access hole cover gasket and reinstall the cover.

(10) Install the transfer assembly (paragraph 5-2).

b. Input Gear Bearing Retainer Seal.

(1) Remove the transfer assembly (paragraph 5-2).

(2) Remove the bearing retainer attaching screws, retainer, and gasket from the housing. Discard the gasket.

(3) Pry the seal out of the retainer.

(4) Apply sealer to the outer diameter of the new seal and install it flush with the housing.

(5) Install the bearing retainer and gasket on the housing and tighten the capscrews to 20 ft-lbs.

(6) Install the transfer assembly (paragraph 5-2).

c. Front Output Shaft Bearing Retainer Seal. The following procedure may be accomplished without removing the transfer assembly.

(1) Remove the front output shaft yoke locknut, washer, and rubber seal. Tap or pry the yoke off the output shaft.

(2) Remove the seal.

(3) Clean and inspect the retainer; replace if defective.

(5) Position the seal on the retainer bore. Using a hammer and drift, install the seal in the retainer (figure 5-5).

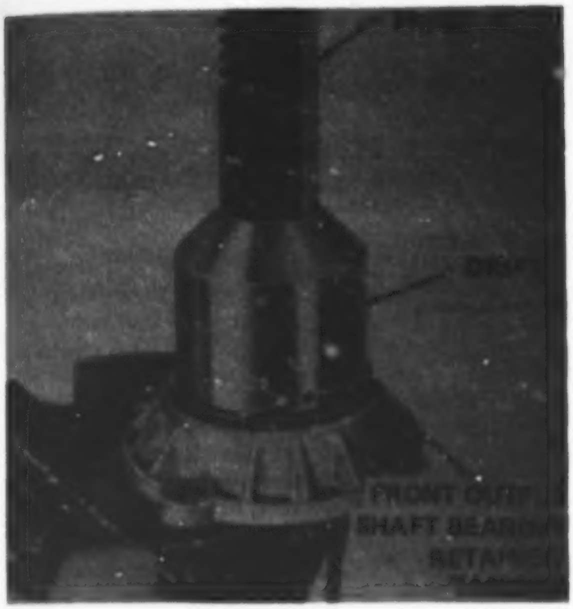


Figure 5-5. Pressing In the Front Output Shaft Seal.

d. ***Front Output Shaft Rear Bearing.*** The following procedure may be accomplished without removing the transfer assembly.

(1) Remove the rear cover from the transfer case. Remove the gasket and discard it.

(2) Support the rear cover and press the bearing from the cover.

(3) Position the new bearing to the outside face of the cover and, using a piece of wood to cover the bearing, press the bearing into the cover until it is flush with the bore opening.

(4) Position the gasket and cover on the transfer case and tap them into place.

(5) Install the retaining bolts and tighten them to 20 ft-lbs.

CHAPTER 6
AXLE ASSEMBLIES

Section I. FRONT AXLE ASSEMBLY (4X4 MODELS ONLY)

6-1. General.

The front driving axle is composed of the outer drive assemblies with ball joints, the differential carrier and tube assembly (axle housing), and the differential case and drive pinion assembly. Replacement parts such as a broken axle shaft, outer drive assembly, wheel bearings, oil seals, universal joints, or brake parts can be serviced without completely removing the axle assembly. Remove the front axle assembly for complete disassembly and inspection in connection with any major repairs.

a. The axle is of the integral carrier-housing, hypoid-gear type, in which the centerline of the drive pinion is mounted below the centerline of the ring gear.

b. The differential housing is an iron casting with tubular axle housings pressed into and welded to the carrier to form an assembly. A removable cover is bolted to the carrier to permit visual inspection of the differential without removing the complete axle from the vehicle.

c. A small metal tag is attached beneath one of the cover screws to identify the axle ratio. This tag is stamped with the number of teeth on the drive pinion and ring gear, and by dividing the larger number (ring gear teeth) by the smaller number (drive pinion), you can determine the axle ratio.

d. The drive pinion is supported by two preloaded taper roller bearing cones. The rear pinion bearing cone is tightly pressed onto the pinion stem; the front pinion bearing is pressed lightly onto the pinion stem. The front and rear bearing cups are pressed against a shoulder recessed in the carrier. The drive pinion depth of mesh adjustment is controlled by shims between the rear pinion bearing cup and the carrier casting.

e. Drive pinion bearing preload is maintained by shim packs between the drive pinion bearing shoulder and the front pinion bearing cone.

f. The differential is supported by two tapered roller bearing cones which are pressed on the differential case hubs. Shims installed between the bearing cone and the shoulder of the hub of the differential perform three functions:

(1) They control differential side play.

(2) They provide a means to adjust and maintain backlash between the ring gear and drive pinion.

(3) They provide a means of setting differential bearing preload.

6-2. Steering Knuckle and Ball Joint.

a. Removal and Disassembly.

(1) Remove the cotter key and loosen the outer axle shaft nut.

(2) Raise the vehicle and install jack stands. Remove the wheel.

(3) Remove the caliper retainer and anti-rattle spring assemblies. Remove the caliper from the disc by sliding it out and away from the disc. Secure the caliper out of the way; do not let it hang or be supported by the hydraulic brake hose. Remove the inside pad.

(4) Using the hole provided in the flange (figure 6-1) remove the six capscrews from the retainer plate.

(5) Remove the outer axle shaft nut. Use a puller to remove the rotor and hub assembly.

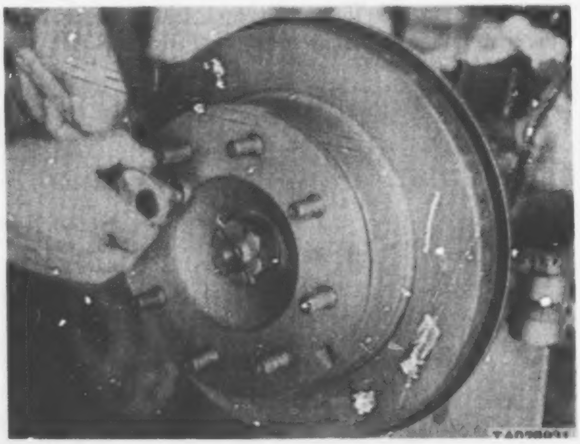


Figure 6-1. Removing Capscrews from Retainer Plate.

(6) Remove and discard the "O" ring from the steering knuckle. Remove the capscrews from the brake splash shield. Remove the disc brake adapter from the steering knuckle.

(7) Disconnect the tie rod from the steering knuckle. Disconnect the drag link from the steering knuckle arm.

(8) Using a punch and hammer, remove the inner oil seal from the rear of the steering knuckle (figure 6-2). Care-

fully slide the outer and inner axle shaft, complete with universal joint, from the axle housing.

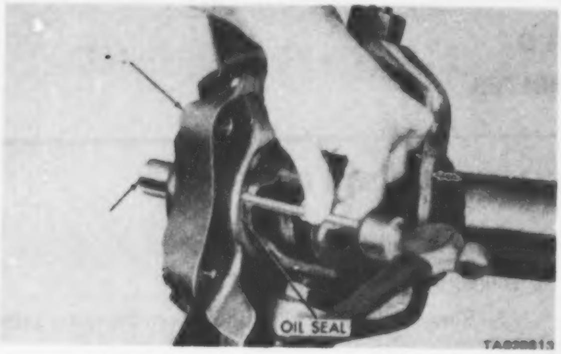

OIL SEAL
TA028813

Figure 6-2. Removing Inner Oil Seal from Steering Knuckle.

(9) Remove the nuts from the steering knuckle arm. Tap the steering knuckle arm to loosen the tapered dowels. Remove the tapered dowels and the steering knuckle arm.

(10) Remove the cotter key from the upper ball joint nut. Remove the upper and lower ball joint nuts.

(11) Using a brass drift and hammer, separate the steering knuckle from the axle housing yoke.

(12) Using tool C-4169, remove and discard the sleeve from the upper ball joint yoke on the axle housing.

(13) Position the steering knuckle in a vise and remove the snap ring from the lower ball joint (figure 6-3).

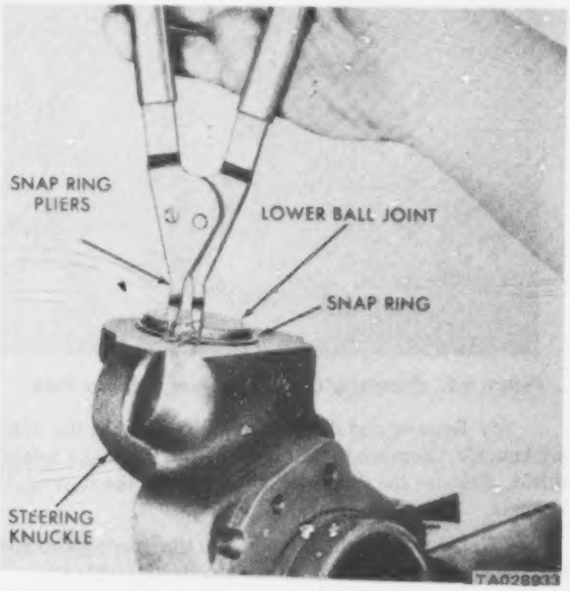

SNAP RING PLIERS
LOWER BALL JOINT
SNAP RING
STEERING KNUCKLE
TA028933

Figure 6-3. Removing or Installing Snap Ring on Lower Ball Joint.

(14) Using tool C-4212-L and components of adapter set C-4288 as shown in figure 6-4, press the lower ball joint from the steering knuckle. Reposition the tool as shown in figure 6-5 and press the upper ball joint from the steering knuckle. Replace the ball joints if inspection indicates wear.

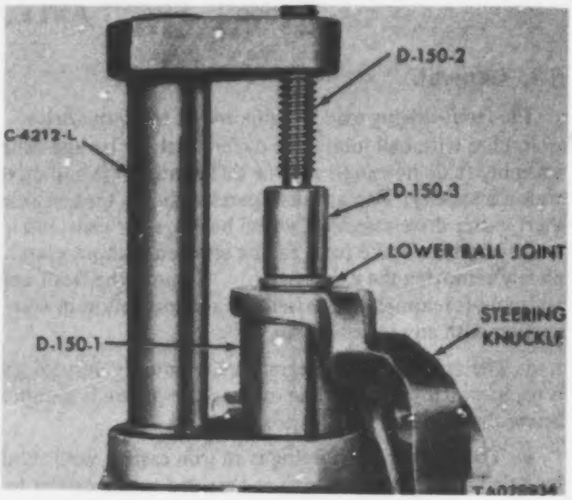

D-150-2
C-4212-L
D-150-3
LOWER BALL JOINT
STEERING KNUCKLE
D-150-1

Figure 6-4. Removing Lower Ball Joint from Steering Knuckle.

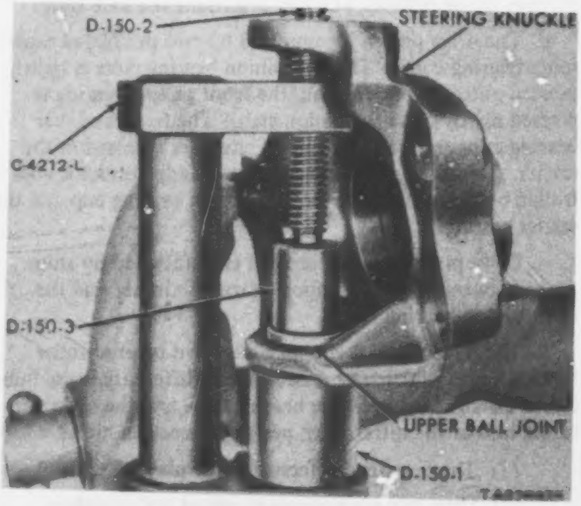

D-150-2
STEERING KNUCKLE
C-4212-L
D-150-3
UPPER BALL JOINT
D-150-1

Figure 6-5. Removing Upper Ball Joint from Steering Knuckle.

(15) Clean all components with solvent and blow then dry with compressed air. Inspect all parts for burrs, chips, or cracks. Replace defective parts.

b. Assembly and Installation.

(1) Position the steering knuckle right side up in a vise. Using tool C-4212-L and adapter set C-4288 positioned as shown in figure 6-6, carefully press the lower ball joint into position. Install the snap ring.

(2) Using tool C-4212-L and adapter set C-4288 positioned as shown in figure 6-7, press the upper ball joint into position. Install boots on both ball joints.

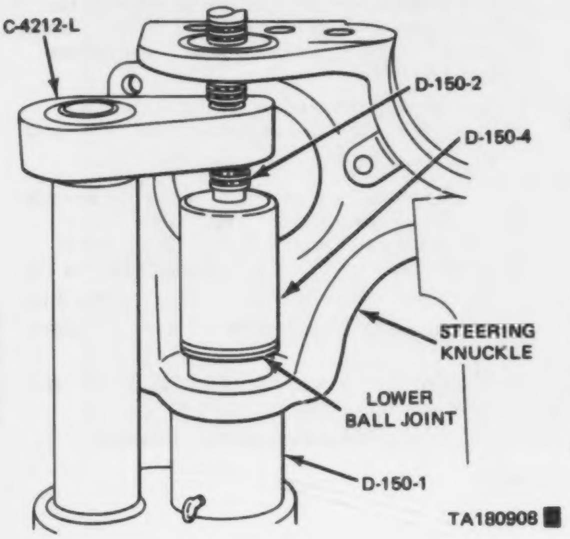


Figure 6-6. Installing Lower Ball Joint.

(3) Screw a new sleeve into the upper ball joint yoke on the axle housing, leaving about two threads showing at the top.

(4) Position the steering knuckle on the axle housing yoke and install a lower ball joint nut. Tighten to 80 ft-lbs.

(5) Using tool C-4169 and a torque wrench, tighten the sleeve in the upper ball joint yoke to 40 ft-lbs. Install the upper ball joint nut and tighten to 100 ft-lbs. Continue to tighten the nut until the slot is alined with the hole in the stud. Install the cotter key.

(6) When working on the left side, position the steering knuckle arm over the studs on the steering knuckle. Install the tapered dowels and nuts. Tighten the nuts to 90 ft-lbs. Assemble the drag link to the steering knuckle arm. Install the nuts and tighten them to 60 ft-lbs. Install the cotter key.

(7) Assemble the tie rod end to the steering knuckle. Install the nut and tighten it to 45 ft-lbs. Install the cotter key.

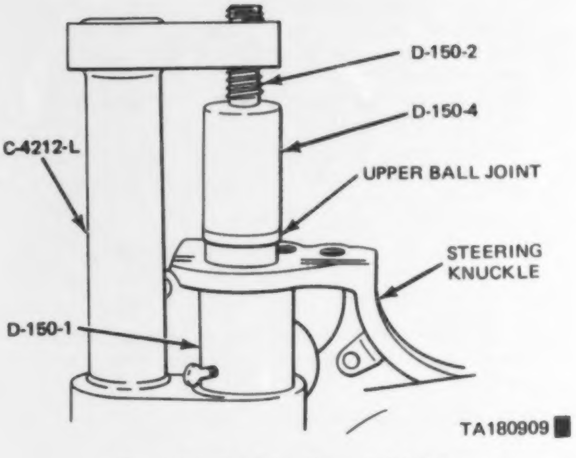


Figure 6-7. Installing Upper Ball Joint.

(8) Slide the axle shaft into position. Using tool C-4250, install a new seal in the steering knuckle (figure 6-8). Install the brake splash shield and tighten the mounting screws. Position the disc brake adapter on the steering knuckle. Install and tighten the mounting bolts to 85 ft-lbs.

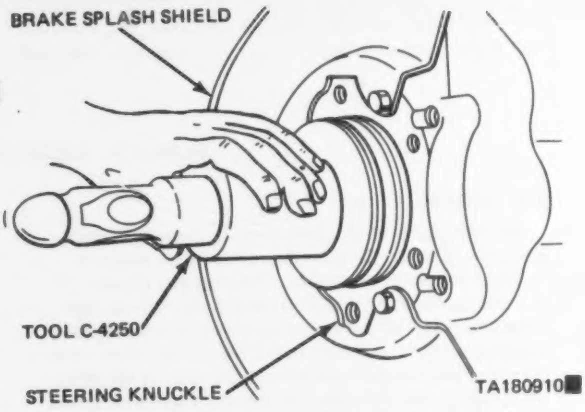


Figure 6-8. Installing Inner Oil Seal in Steering Knuckle.

(9) Install a new "O" ring on the steering knuckle.

(10) Clean any rust from the axle shaft splines. Slide the rotor, hub, retainer, and bearing over the axle shaft and start them into the housing. Install the axle shaft nut.

(11) Through the hole in the flange, aline the retainer to the steering knuckle flange. Install the capscrews and, using a crisscross method to evenly pull the assembly into the steering knuckle housing, tighten them to 30 ft-lbs.

(12) Tighten the axle shaft nut to 100 ft-lbs. Continue to tighten the nut until the next slot in the nut alines with the cotter key. Install the cotter key.

(13) Locate the inside brake pad on the adapter with the flanges in the adapter ways. Slide the caliper assembly into position in the adapter and over the disc. Aline the caliper on the machined ways of the adapter. Be careful not to pull the dust boot from its grooves as the piston and boot slide over the inside pad.

(14) Install the anti-rattle springs and the retaining clips and torque them to 17 ft-lbs.

NOTE

The inside pad anti-rattle spring must always be installed on top of the retainer spring plate.

(15) Install the wheel and tighten the nuts. Lubricate at all fittings. Remove the jack stands and test steering operation.

6-3. Front Axle Assembly.

a. Removal.

(1) Chock the rear wheels. Raise the vehicle and install jack stands.

(2) Disconnect the front propeller shaft at the drive pinion yoke.

(3) Disconnect the drag link at the steering knuckle arm.

(4) Disconnect the flexible hydraulic brakeline at the frame crossmember.

(5) Disconnect the shock absorbers at the lower mounts.

(6) Remove the nuts and washers from the spring "U" bolts. Remove the axle assembly from the vehicle.

b. Installation.

NOTE

If axle assembly is changed, record part number on DA Form 2408-10 (Equipment Component Register).

(1) Position the axle under the vehicle. Put the spring clip plates over the springs with the sway bar mounting bracket holes facing toward the rear. Install the spring "U" bolts, washers, and nuts and tighten them to 110 ft-lbs.

(2) Connect the shock absorbers at the lower mounts. Install the nuts and tighten them to 55 ft-lbs.

(3) Connect the hydraulic brakelines.

(4) Connect the drag link to the steering knuckle arm. Install the castellated nut and tighten it to 60 ft-lbs. Continue to tighten the nut until the slot is alined with the hole in the stud. Install the cotter key.

(5) Connect the front propeller shaft at the drive pinion yoke. Install the washers and nuts and tighten them to 25 ft-lbs.

(6) Bleed the brakes, lubricate at all fittings, and check the differential lubrication level.

(7) Lower the vehicle and test its operation.

Section II. REAR AXLE ASSEMBLY

6-4. General.

The rear axle is of the integral carrier-housing, hypoid-gear type, in which the centerline of the drive pinion is mounted below the centerline of the ring gear (figure 6-9). The rear axle housing is an iron casting with tubular legs pressed into and welded to the carrier to form an assembly. A removable cover is bolted to the rear of the carrier to permit visual inspection of the differential without removing the complete rear axle from the vehicle. For a description of the assembly, see paragraph 6-1.

6-4.1 Axle Backlash Clearance Test.

With the engine off, the transmission in Neutral, and the parking brake applied, use the following procedure to check the axle backlash:

a. Rotate the propeller shaft clockwise as far as it will go. Mark the position on the pinion seal guard and the carrier nose.

b. Rotate the propeller shaft counterclockwise. Mark the pinion seal guard in line with the mark you made on the carrier nose.

c. Measure the distance between the two marks on the pinion seal guard. If the distance is greater than 3/16 inch, replace the rear axle assembly (paragraph 6-5).

6-5. Rear Axle.

a. Removal.

(1) Raise the rear of the truck. Support the body in front of the rear springs.

(2) Chock the front wheels.

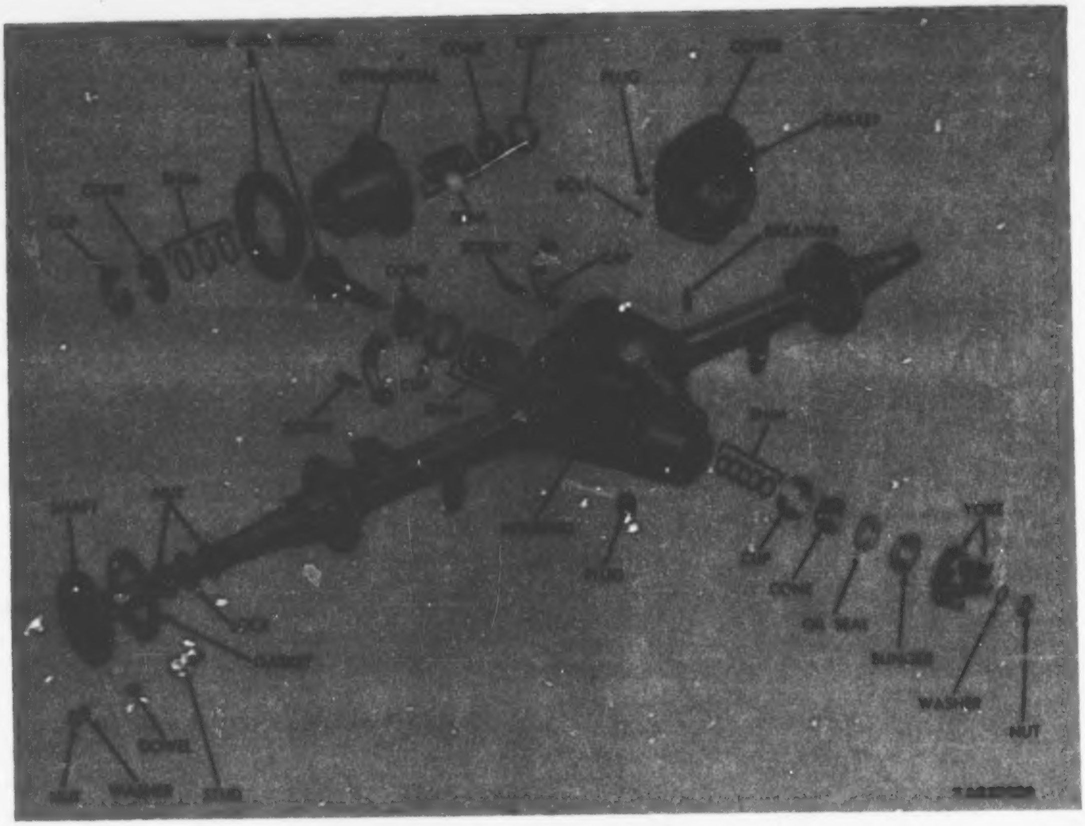

GEAR AND PINION
DIFFERENTIAL
CONE
CUP
PLUG
COVER
GASKET
CUP
CONE
SHIM
BOLT
SHIM
SCREW
PIN
CAP
BREATHER
CONE
CUP
SHIM
SHIM
SHAFT
NUT
HOUSING
PLUG
CUP
CONE
OIL SEAL
SLINGER
YOKE
WASHER
NUT
LOCK
GASKET
DOWEL
NUT
WASHER
STUD

Figure 6-9. Rear Axle Assembly.

(3) Disconnect the hydraulic brakeline at the flexible coupling.

(4) Disconnect the parking brake cables.

(5) Disconnect the rear propeller shaft at the differential pinion flange and secure it out of the way.

(6) Remove the shock absorbers and the rear spring "U" bolts.

(7) Remove the axle assembly from the vehicle.

(8) Remove the axle spacers (4X4 models only).

b. *Installation.*

NOTE

If axle assembly is changed, record part number on DA FORM 2408-10 (Equipment Component Register).

(1) Position the rear axle assembly. On 4X4 models, install the spacers.

(2) Install the spring "U" bolts and tighten the nuts to 180 ft-lbs. Install the shock absorbers. Tighten nuts to 85 ft-lbs.

(3) Connect the parking brake cables.

(4) Connect the hydraulic brakeline at the flexible coupling. Install the hub and drum assemblies.

(5) Install the rear universal joint of the propeller shaft.

(6) Check the brake adjustment and bleed the brakes.

(7) Install the rear wheels.

(8) Lower the truck and check the differential lubricant level. Test for proper operation.

Section III. PROPELLER SHAFTS

6-6. General.

Refer to TM 9-2320-266-20 for instructions on removal and replacement of the propeller shafts and U-joints (except constant velocity U-joint).

6-7. Constant Velocity (CV) U-Joint (4X4 Models Only).

a. *Disassembly.*

(1) Remove the front propeller shaft from the vehicle.

(2) Remove the U-joint bearing cup snaprings, if so equipped.

NOTE

Production model U-joints have plastic retainers instead of snaprings. To disassemble the joint, you will have to break the retainer. You will have to replace the joint since it does not have grooves for a snapring.

(3) Position the U-joint on a workbench or press with the shaft yoke supported by a 1-1/8-inch socket (figure 6-10).

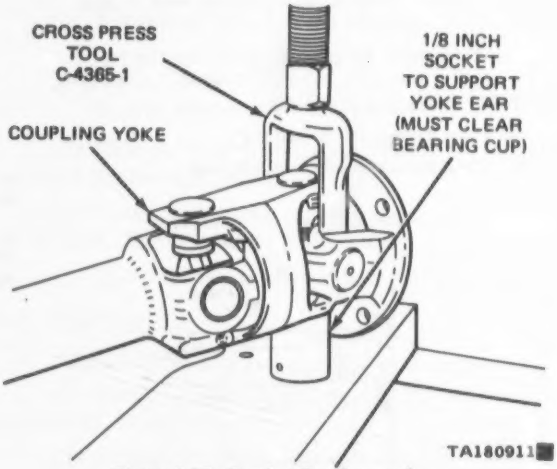


Figure 6-10. Bearing Cup Removal.

(4) Using tool C-4365-1, press (or drive) the lower bearing cup out of the yoke. If the bearing cup will not come out all the way, lift the cross and insert spacer tool C-4365-4 between the seal and bearing cup (figure 6-11). Then, continue to press the cup out.

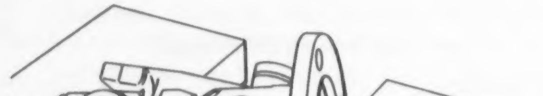


Figure 6-11. Spacer Placement.

(5) Repeat steps *3* and *4*, above, to remove the remaining bearing cups.

b. *Assembly.*

(1) Partially install one bearing cup into one side of the yoke, and turn this yoke to the bottom.

(2) Insert the cross into the yoke so that the bearing cup seats into it. Install the opposite bearing cup part way.

(3) Press the bearing cups into position while working the cross up and down to insure that the bearings don't bind. Continue pressing the cups in until the retaining ring groove of one of the cups clears the inside of the yoke. Install the snapring. Continue to press until the other snap-

ring can be snapped into place. If difficulty is encountered, strike the yoke ear firmly with a hammer to seat the remaining snapring.

(4) Repeat steps *1* through *3*, above, to install the remaining bearing cups.

6-8. Ball Socket.

a. Removal.

(1) Separate the U-joint between the coupling yoke and the flange yoke by pressing out the bearing cups (paragraph 6-7).

(2) Pull the flange yoke and cross, with the ball socket, as a unit from the centering ball.

b. Inspection.

(1) Clean the ball seat insert bushing, and inspect it for wear. If worn, replace the flange yoke and cross assembly.

(2) Pry the seal from the ball cavity.

(3) Remove the washers, spring, and three ball seats.

(4) Clean and inspect the centering ball service seats, spring, and washer. If any of these parts are worn, replace them.

(5) To remove the centering ball, use the following tools: C4365-5, C-4365-6, C-4365-7, C-4365-8, and SP-84. Refer to figure 6-12.

(6) Draw the ball off the ball stud.

(7) Clean and inspect the centering ball.

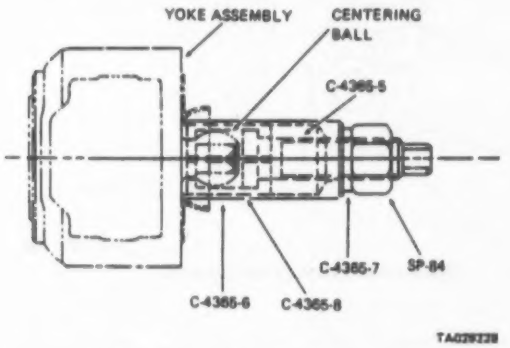


Figure 6-12. Centering Ball Removal.

c. Installation.

(1) Install the centering ball on the stud. Seat the ball on the stud using tool C-4365-3 and a hammer (figure 6-13).

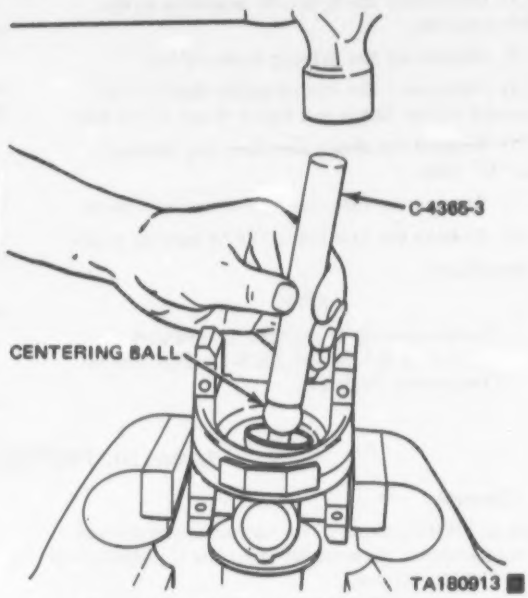


Figure 6-13. Centering Ball Installation.

(2) Using the grease provided in the ball seat kit, lubricate all parts before assembling them into the cavity.

(3) Assemble the ball seat in this order: spring, small outside diameter washer, three ball seats with the large opening facing out, large outside diameter washer, and seal.

NOTE

The ball seat kit comes with two springs. The spring dyed yellow is to be used for this installation. If the springs are not dyed, then use the shortest spring in the kit. Discard the remaining spring.

(4) Lubricate the seal lip. Using a 7/8-inch socket or applicable size tool, press the seal lip in until it is flush with the yoke. The sealing lip should tip inward.

(5) Fill the cavity with the grease that is provided in the kit.

(6) Reassemble the U-joint (paragraph 6-7).

CHAPTER 7

SUSPENSION AND STEERING

Section I. INDEPENDENT FRONT SUSPENSION (4X2 MODELS ONLY)

7-1. General Description and Data.

The 4X2 models are equipped with a coil spring front suspension system. The upper control arms are mounted on longitudinal rails and the lower control arms are mounted on a stationary crossmember. Both control arms have replaceable bushings on the inside ends and replaceable ball joints on the outside ends. The upper control arms also control the caster and camber adjustments through eccentric pivot bolts. Tension-type lower ball joints are used on all models.

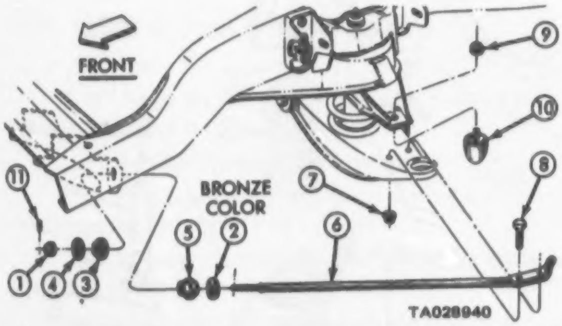
a. Replace the lower ball joints if you find more than 0.020 inch up-and-down movement.

b. Tighten all front suspension points that contain rubber bushings with the full weight of the vehicle on its wheels.

c. Never lubricate rubber bushings.

7-2. Lower Control Arm Strut.

a. Removal. Refer to figure 7-1.



Legend for Figure 7-1:
1. Nut
2. Rear retainer
3. Front bushing
4. Front retainer
5. Rear bushing
6. Strut
7. Nut assembly
8. Bolt
9. Nut
10. Jounce Bumper
11. Spring pin

Figure 7-1. Lower Control Arm Strut and Related Parts.

(1) Raise the vehicle and place it on jack stands.

(2) Using a small drift and hammer, drive the spring pin (11) from the front of the strut (6). Remove the spring pin, nut, retainers (2,4), and bushings (3,5).

(3) Remove nuts (7) and rear mounting bolts (8). Remove the strut.

b. Installation.

(1) Position the retainers and bushings on the strut.

NOTE

The rear retainer is bronze in color.

(2) Slide the strut into position. Install the mounting bolts and tighten to 85 ft-lbs.

(3) Install the bushing, retainer, and nut at the front of the strut. Tighten the nut to 50 ft-lbs.

(4) Install the spring pin and lower the vehicle.

7-3. Coil Spring.

a. Removal.

(1) Chock the rear wheels and raise the vehicle on jack stands. Remove the wheel.

(2) Remove the brake caliper and secure it out of the way. Do not allow the caliper to hang or be supported by the hydraulic brake hose.

(3) Remove the grease cap, cotter key, locknut, adjusting nut, washer, and outer bearing.

(4) Slide the rotor from the steering knuckle. Do not drag the seal or inner bearing over the steering knuckle thread. The thread, bearing, or oil seal may be damaged.

(5) Remove the mounting screws and the brake splash shield.

(6) Disconnect the sway bar from the lower control arm.

(7) Place a jack under the lower control arm and allow 1/2-inch clearance between the jack and the arm.

(8) Remove the cotter key and back off the nut on the lower ball joint hub until the top threads are protected.

(9) Using a brass drift, strike the ball joint stud until the ball joint has separated from the steering knuckle (figure 7-2).

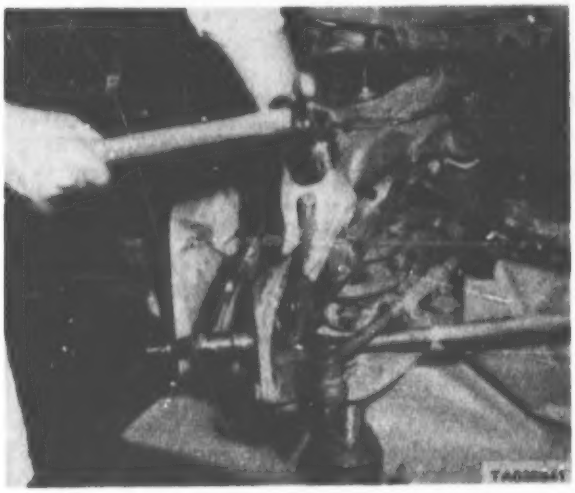


Figure 7-2. Removing Lower Ball Joint from Steering Knuckle.

(10) Use the jack under the lower control to compress the coil spring.

(11) Remove the top shock absorber nut.

(12) Remove the lower ball joint stud nut.

(13) Slowly release the jack pressure until the coil spring pressure is eliminated.

(14) Remove the lower shock absorber retaining nuts.

(15) Remove the shock absorber.

(16) Remove the spring.

b. Installation.

(1) Position the spring on the lower control arm. Using a jack under the control arm, compress the spring until the ball joint is properly positioned in the steering knuckle.

(2) Install the ball joint nut and tighten to 135 ft-lbs. Install the cotter key.

(3) Install the upper shock absorber bushing and sleeve. Position the shock absorber, and install the upper retainer and nut and lower mounting bolts. Tighten the upper nut to 25 ft-lbs and the lower mounting bolts to 17 ft-lbs (200 in-lbs).

(4) Connect the sway bar and tighten the link to 75 ft-lbs. Remove the jack.

(5) Position the brake splash shield on the steering knuckle and install the mounting screws.

(6) Slide the rotor assembly onto the spindle, followed by the outer bearing, washer and nut. Tighten the adjusting nut to 27 ft-lbs (320 in-lbs) while rotating the rotor. Back off the adjusting nut to completely release the bearing preload. Next, tighten the adjusting nut. Install the locknut and cotter key.

(7) Install the grease cap.

(8) Install the caliper on the rotor. Install and tighten the mounting bolts.

(9) Install and tighten the wheel.

(10) Remove the jack stands and lower the vehicle.

(11) Test operation.

7-4. Lower Control Arm and Bushing.

a. Removal.

(1) Follow the coil spring removal procedure in paragraph 7-3.

(2) Remove the nut (5, figure 7-3) and the hex head mounting bolt (4) from the crossmember.

(3) Remove the lower control arm (11).

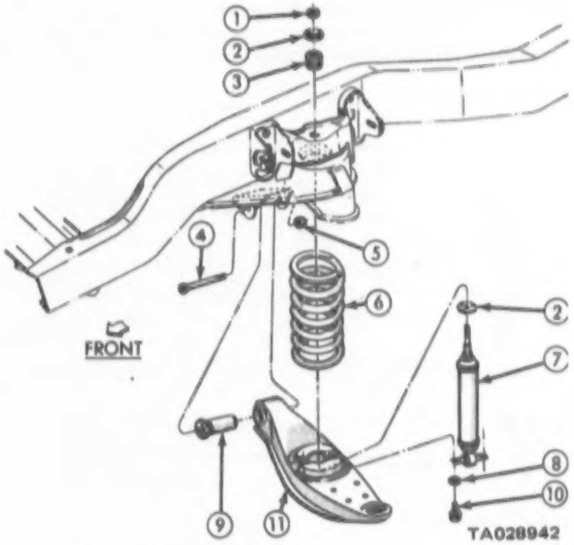
(4) Press out the bushing (3).

b. Installation.

(1) Press in a new bushing.

(2) Position the lower control arm on the vehicle.

(3) Install the hex head mounting bolt finger-tight.



Legend for Figure 7-3:

1. Nut
2. Retainer
3. Bushing
4. Bolt
5. Nut
6. Coil spring
7. Shock absorber
8. Washer
9. Bushing assembly
10. Capscrew
11. Lower control arm

Figure 7-3. Lower Control Arm and Related Parts.

(4) Follow the coil spring installation procedure in paragraph 7-3.

(5) After the vehicle has been lowered to a driving position, tighten the hex head mounting bolt to 210 ft-lbs.

7-5. Lower Ball Joint.

a. Inspection.

(1) Chock the rear wheels and raise the front end on jack stands. The tire should be about 3 inches off the floor.

(2) Have an assistant insert one end of a metal rod (about 6 feet long) under the tire, and alternately lift and release the free end of the rod. He should lift with strong pressure.

(3) As the assistant lifts, watch the ball joint. If you see more than one-eighth inch up-and-down free play, replace the ball joint (b and c, below).

b. Removal.

(1) Follow the coil spring removal procedure in paragraph 7-3.

(2) Loosen the lower control arm mounting bolt.

(3) Remove the ball joint seal.

(4) Using tool C-4212-L, press the ball joint from the lower control arm.

c. Installation.

(1) Using tool C-4212-L, press the new ball joint into the lower control arm.

(2) Press the ball joint seal into the lower ball joint.

(3) Follow the coil spring installation procedure outlined in paragraph 7-3.

(4) After the vehicle has been lowered to a driving position, tighten the hex head mounting bolt to 210 ft-lbs.

7-6. Upper Control Arm and Bushing.

a. Removal.

(1) Chock the rear wheels, Raise the front of the vehicle and place it on jack stands.

(2) Remove the wheel and tire assembly.

(3) Place a jack under the lower control arm and compress the coil spring 1 to 2 inches.

(4) Remove the cotter key and loosen the nut one-half inch on the upper ball joint stud.

(5) Using a pry bar, press up on the control arm, and, at the same time, strike the steering knuckle with a hammer as shown in figure 7-4.

(6) After the upper ball joint has separated from the steering knuckle, remove the nut, and remove the eccentric pivot bolts and the control arm.

(7) Place the control arm in a vise and assemble tool C-3962 over the bushing (figure 7-5). Press the bushing out of the arm.

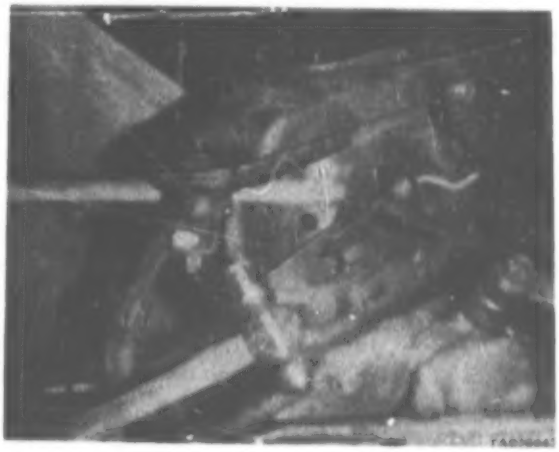


Figure 7-4. Freeing the Upper Ball Joint from the Steering Knuckle.

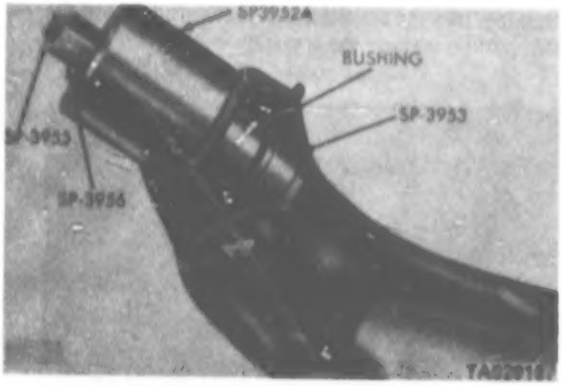
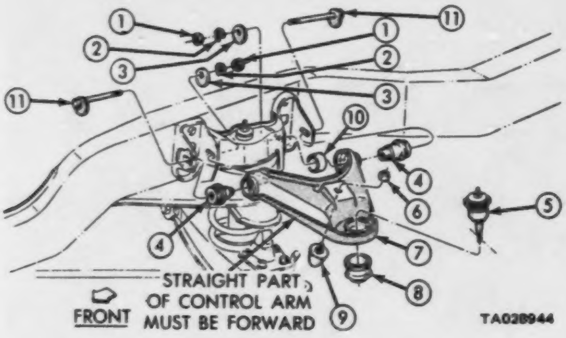


Figure 7-5. Removing Upper Control Arm Bushing.

b. Installation. Refer to figure 7-6. When installing new bushings, be sure the control arm is supported squarely at the point where the bushing is being pressed in. Do not use oil or grease to aid in installation.



Legend for Figure 7-6:

1. Nut
2. Lockwasher
3. Cam
4. Bushing assembly
5. Ball joint
6. Locknut
7. Upper control arm
8. Upper ball joint
9. Bumper assembly
10. Sleeve
11. Cam and bolt assembly

Figure 7-6. Upper Control Arm.

(1) Position the flange end of the new bushing in tool C-3962. Support the control arm squarely, and press the bushings into the control arm (from outside) until the tapered portion seats on the arm (figure 7-7).

Figure 7-7. Installing Upper Control Arm Bushing.

(2) Position the control arm and install the eccentric pivot bolts and nuts finger-tight.

(3) Install the nuts on the ball joint and tighten to 135 ft-lbs. Install the cotter key.

(4) Install the wheel. Lower the vehicle and remove the jack.

(5) Adjust the caster and camber. Tighten the eccentric pivot bolts to 70 ft-lbs.

7-7. Upper Ball Joint.

a. Removal.

(1) Follow the procedure outlined in paragraph 7-6 for separating the upper ball joint from the steering knuckle.

(2) Using tool C-3561, loosen the ball joint retaining nut, then remove the ball joint from the upper control arm.

b. Installation.

(1) Screw the new ball joint into the control arm as far as possible by hand. Using tool C-3561, tighten the ball joint to 125 ft-lbs. Be sure it is seated fully against the arm.

(2) Press the ball joint seal onto the upper ball joint.

(3) Insert the ball joint into the steering knuckle. Install the ball joint nut; tighten it to 135 ft-lbs. Install the cotter keys.

(4) Install the wheel, lower the vehicle, and remove the jack stands.

7-8. Steering Knuckle.

a. Removal.

(1) Chock the rear wheels, raise the vehicle, and remove the wheel.

(2) Remove the caliper from the rotor. Secure the caliper out of the way.

(3) Remove the grease cap, cotter key, nut, washer, and outer bearing.

(4) Slide the rotor assembly from the steering knuckle. Do not drag the seal or inner bearing over the steering knuckle thread or the thread, bearing, and oil seal may be damaged.

(5) Disconnect the tie rod at the steering knuckle arm (see TM 9-2320-266-20).

(6) Separate the steering knuckle from the ball joints following the procedure in paragraphs 7-3 and 7-6. Place the assembly on a bench.

(7) Separate the components.

b. Installation.

(1) Position the seal on the steering knuckle. Install an adapter and tighten the mounting bolts to 100 ft-lbs.

(2) Aline the steering knuckle arm to the steering knuckle. Install the mounting bolts and tighten them to 215 ft-lbs.

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(3) Mount the steering knuckle to the control arms and install the ball joint nuts. Tighten them to 135 ft-lbs. Install the cotter keys.

(4) Connect the tie rod end. Install and tighten the nut to 40 ft-lbs. Install the cotter key.

(5) Slide the rotor assembly into position. Install the outer bearing, washer, and nut. Adjust the wheel bearing and install the cotter key and grease cap.

(6) Install the brake caliper and pads.

(7) Install the wheel.

(8) Remove the jack, lower the vehicle, and test operation.

Section II. MAINTENANCE OF THE SPRINGS

7-9. General.

a. 4X2 Models. The 4X2 trucks use coil springs on the front and progressive-type leaf springs (figure 7-9) on the rear. Removal and installation instructions for the front coil springs are contained in section I of this chapter. The progressive-type rear springs used on the rear of these trucks operate in two stages. The first stage, comprised of the upper leaves, provides a low spring rate with light loads. With heavier loads, the second stage of the springs gradually comes into use. The lower leaves comes into contact with the upper leaves, providing increased spring rate.

b. 4X4 Models. The 4X4 trucks use leaf-type, fixed-rate springs on the front and the progressive type on the rear (figures 7-8 and 7-9).

NOTE

Models equipped with the S-250 Shelter Kit (M883, M884, and M885) are equipped with additional rear auxiliary springs.

Figure 7-8. Progressive Type Spring.

7-10. Front Springs in the 4X4 Model.

a. Removal. Refer to figure 7-10.

(1) Using a lifting hoist hooked to the towing eyes or to the frame attachment, raise the truck. Install jack stands.

(2) Remove the "U" bolts securing the spring to the axle.

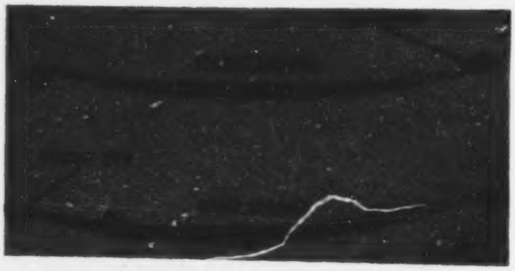


Figure 7-9. Leaf Spring Assemblies (4X4 Models).

(3) Remove the spring shackle bolts, shackles, and the spring front eye bolt. Remove the spring.

b. Installation. Refer to figure 7-10.

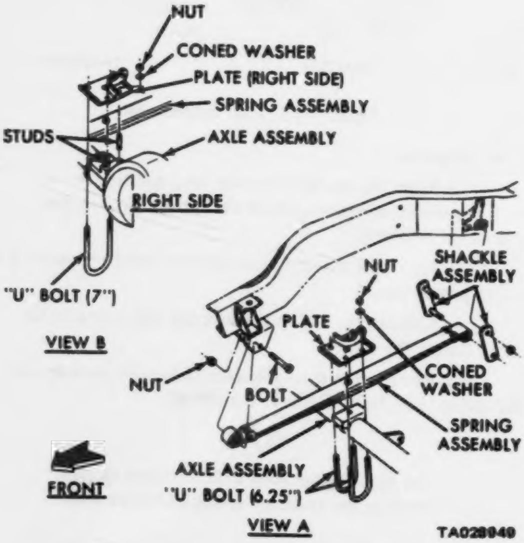


Figure 7-10. Front Suspension (4X4 Models).

(1) Line up the spring fixed eye with the bolt hole in the bracket and install the spring bolt and nut.

(2) Install the shackle bolts, shackles, and nuts.

Tighten the shackle bolt nuts and the fixed eye bolt nut until the slack is taken up.

(3) Position the spring on the axle so the spring center bolt enters the locating hole in the axle pad.

(4) Install the "U" bolts.

(5) Remove the jack stands and lower the truck. Tighten the "U" bolt nuts to 110 ft-lbs, and the spring eye bolt nuts and the shackle bolt nuts to 80 ft-lbs. Do not lubricate the rubber bushings.

7-11. Rear Springs.

Refer to figures 7-11 and 7-12.

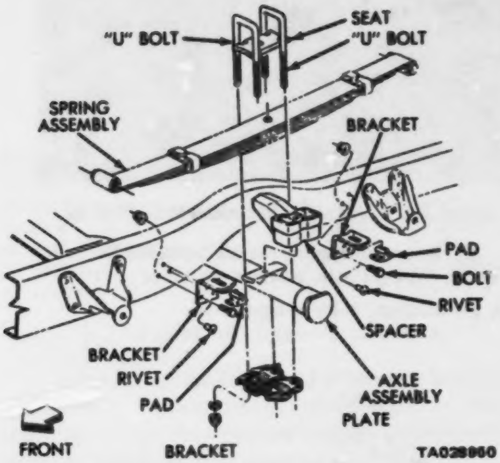


Figure 7-11. Rear Suspension.

a. Removal.

(1) Raise the rear of the truck with a lifting hoist until the weight is removed from the springs (wheels just touching the floor).

(2) Place jack stands under the side frame members as a safety precaution.

(3) Remove the "U" bolts securing the spring to the axle. Retain the spacers.

(4) Remove the spring shackle bolts, the shackle, and the spring front bolt. Remove the spring.

NOTE

On models equipped with auxiliary springs, remove the auxiliary spring and extra seat.

b. Installing a New Leaf.

(1) Clamp the spring in a vise as shown in figure 7-12. Loosen or remove the spring leaf alinement clips and remove the center bolt.

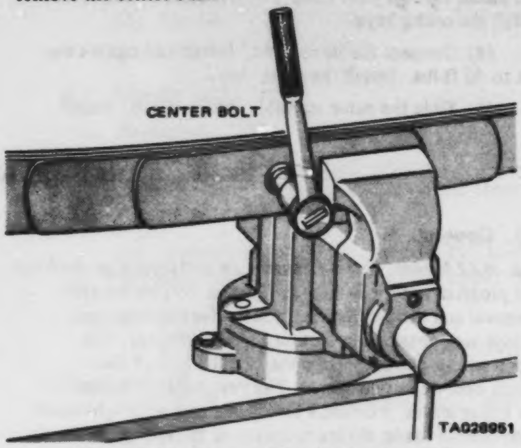


Figure 7-12. Disassembling Spring Assembly.

(2) Insert a long drift in the center bolt hole and release the vise slowly.

(3) Remove the assembly from the vise and replace the broken leaf.

(4) Place the spring assembly in a vise. Slowly tighten the vise while holding the spring leaves in alinement with the drift.

(5) Remove the drift, install the center bolt (figure 7-12), and torque to 40 ft-lbs.

(6) Reinstall the alinement clips, and remove the spring from the vise.

c. Installation.

(1) Position the spring on the axle so the spring center bolt enters the axle housing pad.

(2) Line up the spring front eye with the bolt hole in the bracket and install the spring bolt and nut.

(3) Install the rear shackle, bolts, and nuts. Tighten the shackle bolt nuts and the front bolt nut until the slack is taken up.

(4) Install the "U" bolts.

NOTE

On models equipped with auxiliary springs, position the spring and seat before installing the "U" bolts.

(5) Remove the jack stands and lower the truck. Tighten the "U" bolt nuts to 110 ft-lbs, and the spring eye bolt nuts and the shackle bolt nuts to 160 ft-lbs.

Section III. STEERING GEAR

7-12. General.

The steering gear is designed to provide easy steering. A ball nut travels up or down on the wormshaft, riding on recirculating balls which act as a screw thread. The wormshaft and ball nut assembly is supported in the gear housing by an adjustable ball thrust-type upper and lower bearing. The sector shaft is integral with the sector gear. The sector gear meshes with the rack teeth on the recirculating ball nut. Adjustment at this point is controlled by the sector shaft adjusting screw which extends through the housing cover. The teeth on the sector and the ball nut are so designed that a tighter fit exists between the two when the front wheels are straight ahead. Proper engagement between the sector and the ball nut is obtained by an adjusting screw which permits the desired engagement of the tapered teeth of the ball nut and sector gear. The worm bearing adjuster can be turned to provide proper preloading of the upper and lower worm thrust bearings.

7-13. Adjustments.

Two adjustments are provided in the steering gear: the worm bearing preload adjustment, and the ball nut gear mesh lash adjustment. Before the correct adjustment can be made at the ball nut rack and the sector gear, it must be determined that the worm thrust bearing adjuster plug is set for the proper worm bearing preload. The adjuster threads into the housing at the lower end of the wormshaft.

a. Worm Bearing Preload. Preload is determined by the pressure exerted against the wormshaft by the adjuster plug. See figure 7-13.

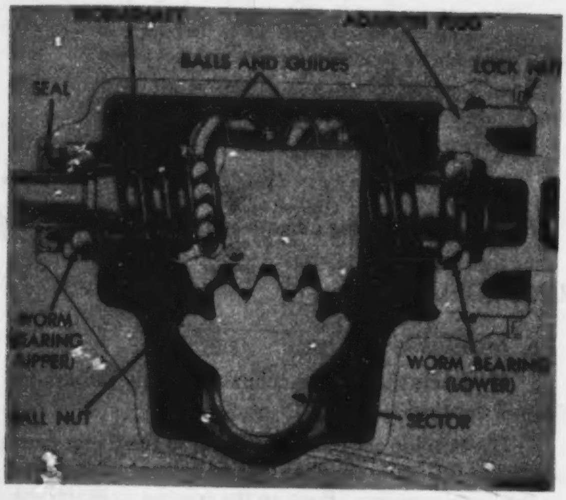


Figure 7-13. Steering Gear.

(1) Turn the front wheels to the straight-ahead position.

(2) Disconnect and remove the steering gear arm from the sector shaft.

(3) Remove the horn pad to expose the steering shaft nut.

(4) Turn the steering wheel all the way to the right, then back it off slightly to relieve any binding.

(5) Place an inch-pound torque wrench on the steering shaft nut.

(6) Use the wrench to rotate the steering shaft toward the left, while reading the torque. The torque required to keep the steering shaft nut moving should be from 4 to 6 in-lbs.

NOTE

There is a "high spot" in the center of the sector gear to increase turning torque when the wheels point straight ahead. Always test preload torque with the steering wheel turned well away from center.

(7) If the torque reading is not between 4 and 6 in-lbs, adjust bearing preload as follows:

(a) Loosen the adjuster locknut two turns.

(b) Back out the adjuster plug one turn to completely relieve worm bearing preload.

(c) Turn the adjuster plug clockwise until the torque reading is within specification (4-6 in-lbs).

(d) While keeping the adjuster plug from turning, tighten the locknut securely. Then retest torque.

(8) When worm bearing preload is 4-6 in-lbs, adjust the ball nut rack and sector mesh (*b*, below).

b. Ball Nut Rack and Sector Mesh. The lash adjuster screw (figure 7-14), located in the housing cover, raises or lowers the sector shaft to provide proper mesh between the tapered sector gear teeth and the tapered ball nut teeth. Adjust this mesh only after establishing the proper worm bearing preload (*a*, above).

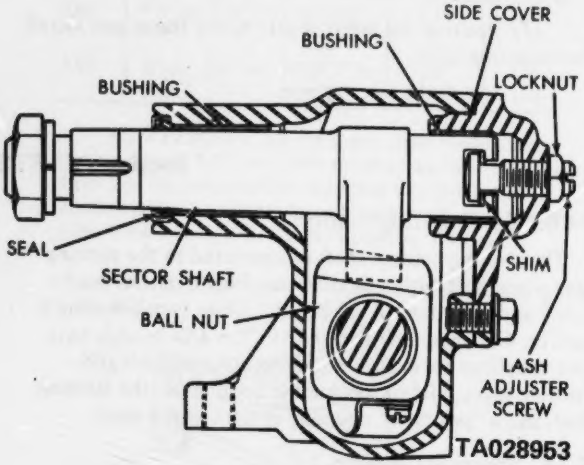


Figure 7-14. Steering Gear (Including Lash Adjuster Screw).

(1) Turn the steering wheel from one stop to the other, keeping careful track of the number of turns. Turn the steering wheel back exactly halfway to the center position.

(2) Turn the steering wheel about one-quarter turn away from the center ("high spot") position. Place an inch-pound torque wrench on the steering shaft nut.

(3) Use the wrench to rotate the steering wheel through the center ("high spot") position, while reading the torque. This reading is the total of the worm shaft bearing preload and the "high spot" sector gear mesh load. The torque required to rotate through the center position should be 14 in-lbs.

(4) If the torque reading is not 13-15 in-lbs, adjust sector gear mesh as follows:

(a) Loosen the lash adjuster screw locknut and turn out the adjuster screw enough to take out all lash between the ball nut rack and the sector gear teeth.

(b) Adjust the lash adjuster screw to obtain a 14 in-lbs torque wrench reading through the center ("high

spot") position. Then tighten the locknut securely and check the torque reading again.

(5) When torque through the center position is 14 in-lbs, place the wheels in the straight-ahead position and install the steering arm.

(6) Tighten the steering arm retaining nut to 180 ft-lbs.

7-14. Steering Gear.

a. Removal.

(1) Remove the two wormshaft-to-column coupling bolts (figure 7-15).

(2) Remove the steering arm from the steering gear.

(3) Remove the steering gear-to-frame bolts and remove the gear from the vehicle.

b. Installation.

(1) Position the steering gear to the frame and install the mounting bolts.

(2) Install the steering arm.

(3) Install the wormshaft-to-column coupling bolts.

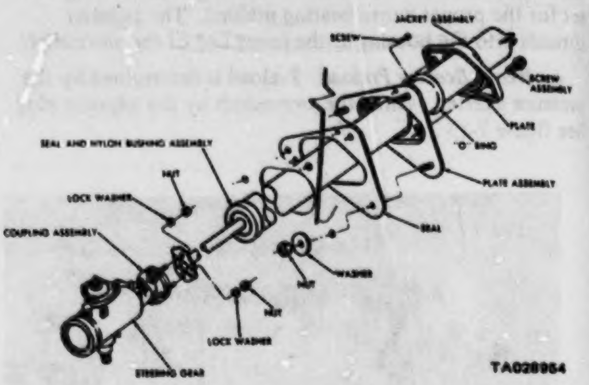


Figure 7-15. Steering Column and Gear Assembly.

Section IV. STEERING COLUMN

7-15. General Information.

The steering column shaft is connected to the steering gear wormshaft with a flexible coupling to absorb road shock and vibration. A rubber and fabric type coupling is used on 4X2 models (figure 7-15). The 4X4 models have two couplings between the steering column shaft and steering gear: a fabric and rubber coupling at the steering gear, and a "pot type" coupling at the column shaft.

7-16. Steering Column.

a. Removal.

(1) Disconnect the negative (ground) terminal at the battery.

(2) Disconnect the shift linkage from the lower end of the steering column.

(3) Remove the two nuts and lockwashers from the flexible coupling (figure 7-15). On 4X4 models, remove the pot coupling roll pin.

(4) Disconnect the electrical wiring connector at the steering column jacket.

(5) Remove the horn pad. Disconnect the horn wire and remove the horn switch.

(6) Remove the steering wheel retaining nut and washer. Using an appropriate puller, remove the steering wheel.

(7) Loosen the "O" ring retaining plate screws and remove the support plate screws (figure 7-15).

(8) Remove the trim panel and the nuts or bolts attaching the steering column clamp to the instrument panel support.

(9) Lift the column out through the cab.

b. Installation.

(1) Insert the steering column assembly throuth the firewall opening.

(2) Position the steering column so the flange face is parallel to the fabric coupling face to prevent undue stress on the fabric coupling. Position the column to center the steering shaft bearing blocks in the pot coupling on the 4X4 models.

(3) Connect the steering column coupling flange with the rubber and fabric type coupling on the steering gear wormshaft.

(4) Install the two steering column upper bracket bolts. Tighten them finger-tight.

(5) With the front wheels in the straight-ahead position, center the shaft in the tube.

(6) Position the support plate to the firewall and tighten the screws. Slide the "O" ring into position on the support plate and secure it with the two screws.

(7) Tighten the steering column bracket bolts to 110 in-lbs. Tighten the steering column coupling-to-steering gear flange nuts to 20 ft-lbs.

(8) Connect the gearshift indicator pointer to the operating bracket on the shift housing in its approximate original location. Slowly move the gear selector lever from "1" to "P", pausing briefly at each selector position. The indicator pointer must aline with each selector position. If necessary, loosen the bolt and readjust it to aline the pointer correctly.

(9) Place the steering wheel on the steering shaft with the master splines alined. Install the retaining nut and washer, and tighten the nut to 27 ft-lbs. Do not drive the

wheel on the shaft. Draw the wheel down with the retaining nut.

(10) Install the horn switch parts previously removed from the steering wheel. Connect the horn switch wire.

(11) Connect the wiring connectors at the steering column jacket. Connect the battery ground cable and test the operation of the lights and horns.

(12) Connect and adjust the gearshift linkage.

Section V. WHEEL ALINEMENT

7-17. General.

Refer to figure 7-16.

a. Camber. Camber is the number of degrees that the top of the wheel is tilted inward or outward from a true vertical. Inward tilt is negative camber; outward tilt is positive camber.

b. Caster. Caster is the number of degrees of forward or backward tilt at the top of the spindle support arm. Forward tilt is negative caster; backward tilt is positive caster.

c. Toe-in. The leading edges of the front tires are closer together than the trailing edges. This distance, measured in fractions of an inch, is called toe-in.

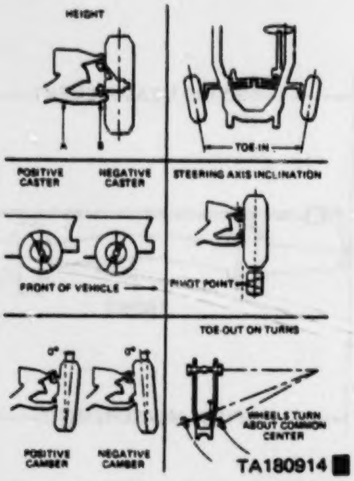


Figure 7-16. Wheel Alinement Factors.

7-18. Pre-Alinement Inspection.

a. Before adjusting wheel alinement, inspect the truck for worn, damaged, or badly adjusted steering and suspension components. In this inspection, be sure to include the front wheel bearings, radial and lateral tire runout, wheel balance, ball joints and steering linkage pivot points, and shock absorbers. Adjust the steering gear, if necessary. Check the rear springs for cracked or broken leaves. Make any necessary corrections before alining the wheels.

b. Remove all foreign material from exposed threads of the cam adjusting bolts. Make other preparations in accordance with your equipment operating instructions.

7-19. Alinement Procedures.

a. Check/Adjust Camber. Use the wheel alinement indicator.

(1) 4X4 Models. When checking camber, always take two readings on opposite sides of the wheel and average the two readings. If camber is not correct (table 7-1), replace the steering knuckle and repeat the procedure. If camber still is not correct, repair or replace the axle.

Table 7-1. Wheel Alinement Specifications

Truck model	Camber	Caster	Toe-in	Turning angle (left)	Turning angle (right)
4X4	+.5° to 1.5°	+1° to +3°	±0.125"	35°	24°
4X2	0° to +0.5°	0° to +1°	0.063" to 0.125"	33°	33°

(2) 4X2 Models. On the upper, inner control arm bushing (figure 7-17) turn both the front and the rear adjustment nuts the same number of degrees to adjust camber. Turning toward the frame decreases positive camber; turning them toward the spindle increases positive camber.

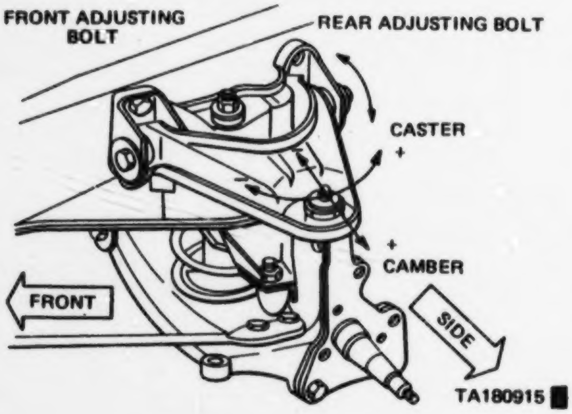


Figure 7-17. 4X2 Alinement Adjustment Locations and Directions.

b. Adjust Caster. Check caster with the truck unloaded. Low positive caster (tilting of the kingpin toward the rear) keeps the steering wheel from returning to the straight-ahead position during turns. High positive caster increases the tendency of the steering wheel to turn straight ahead, causing increased steering effort. See figure 7-18.

(1) Make sure camber is within limits (*a*, above).

(2) Measure caster of the left wheel with the wheels turned 20 degrees to the right, then 20 degrees to the left.

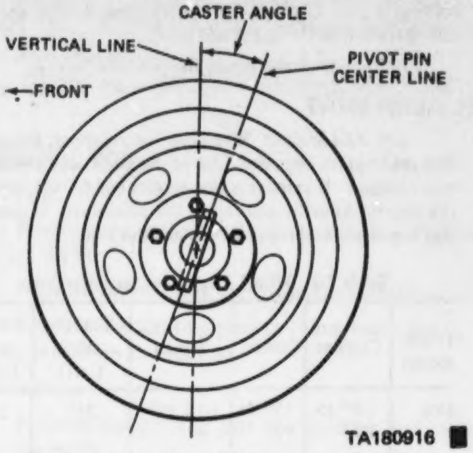


Figure 7-18. Positive Caster Angle.

Paragraph 7-19 b (3) deleted.

Figure 7-19 is deleted.

(4) To adjust left wheel caster on 4X2 models, turn the upper, inner control arm bushing adjustment nuts (figure 7-17) separately. The front adjustment nut controls negative caster; the rear adjustment nut controls positive caster. If you adjust one wheel, always adjust the other as well.

(5) Check and adjust the right wheel in the same manner, but start by turning the front wheels to the left.

NOTE

The truck will tend to pull toward the side with the least positive (or most negative) caster. Most highways are designed with the center higher than the sides, so if you can't set both wheels exactly equal, put the *least* positive caster on the left wheel.

c. *Adjust Toe-In.* Refer to figure 7-20. Always make sure caster and camber are correct before you adjust toe-in. Make the adjustment as follows:

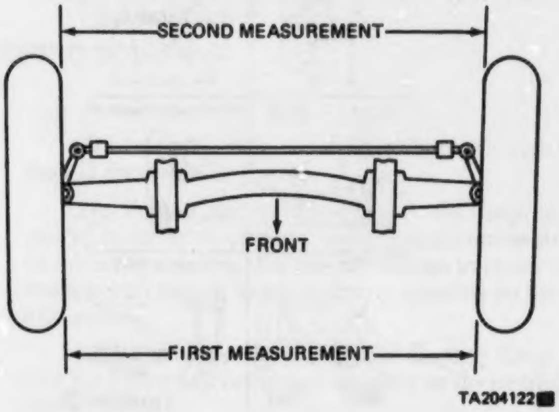


Figure 7-20. Front Wheel Toe-In.

(1) Turn the front wheels to the exact straight-ahead position.

(2) Roll the truck ahead one full revolution of the wheels, with the full weight of the truck on the wheels.

(3) Using a toe-in gage (bar), check the distance between the inside edges of the front tires at hub height. Note the reading.

(4) With the bar still in place, roll the truck ahead until the two measurement points are in the rear at the same (hub) height.

(5) Check the distance between the tires and note the reading. Toe-in is the amount that the second (rear) reading is *greater* than the first (front) reading. Acceptable toe-in readings are:

(a) 4X4 Models. Toe-in should be ± 1/8 inch.

(b) 4X2 models. Toe-in should be 1/16 to 1/8 inch.

(6) Loosen the clamping bolts on both ends of the tie rod sleeve.

(7) Turn the tie rod sleeve in the direction required to bring toe-in within limits.

NOTE

On 4X2 models, turn each side equally to maintain a centered steering wheel.

(8) Tighten the clamping bolts on the tie rod ends.

(9) Check the toe-in again to make sure it is correct.

d. Adjust Turning Angle. When adjusting the turning angle, take your readings with the wheels turned full-left or full-right. If turning angle is not correct (table 7-1), loosen or tighten the stop screw until it just contacts the axle housing when the wheels are at the specified angle. Tack-weld the screw to the locknut and repeat the procedure for the other side of the truck.

CHAPTER 8

REPAIR OF THE BODY AND SHEET METAL

8-1. Replacing Body Components.

Instructions for replacing body components of the trucks are contained in TM 9-2320-266-20.

8-2. Body and Sheet Metal Repair.

a. Body and sheet metal components may be repaired using the methods set forth in TM 9-450 (Metal Body Repair and Related Operations). When welding is required, use heliarc (or equivalent) type equipment to avoid overheating or changing the metal characteristics.

b. To make some of the repairs on the ambulance models, it will be necessary to use a rivet gun.

8-3. Windshield.

a. Removal. Refer to figure 8-1.

Figure 8-1. Windshield Removal.

(1) Cover the cowl grille to protect the paint.

(2) Remove the wiper arms and blades (TM 9-2320-266-20).

(3) Remove the rubber locking strip from outside the weatherstrip.

(4) Have an assistant support the windshield from the outside. From inside the cab, progressively force the entire glass out of the weatherstrip.

b. Installation. Refer to figure 8-2.

Figure 8-2. Windshield Installation.

(1) With an assistant helping, slide one corner of the glass into the lower glass groove of the weatherstrip.

(2) Move the glass into the groove as far as possible. Use a fiber wedge to force the lip of the weatherstrip over the glass around its entire circumference.

CAUTION

Use mineral spirits ONLY, if you need to use a lubricant while installing the windshield. Other lubricants will damage the weatherstrip.

(3) Starting at one of the lower windshield corners, insert the locking strip in the groove. Be careful not to overstretch the locking strip.

(4) Test the windshield area by spraying it with water and inspecting for leaks.

(5) Install the windshield wiper arms and blades (TM 9-2320-266-20).

8-4. Replacing the Rear Window.

Removing and installing the rear window is similar to removing and installing the windshield, except the operation requires only one person. Refer to figures 8-3, 8-4, and 8-5.

Figure 8-3. Rear Window Removal.

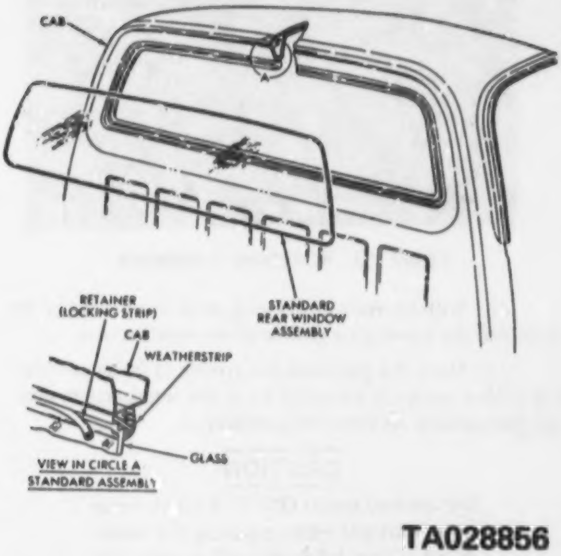

CAB
A
RETAINER (LOCKING STRIP)
CAB
WEATHERSTRIP
STANDARD REAR WINDOW ASSEMBLY
GLASS
VIEW IN CIRCLE A STANDARD ASSEMBLY
TA028856

Figure 8-4. Rear Window Installation.

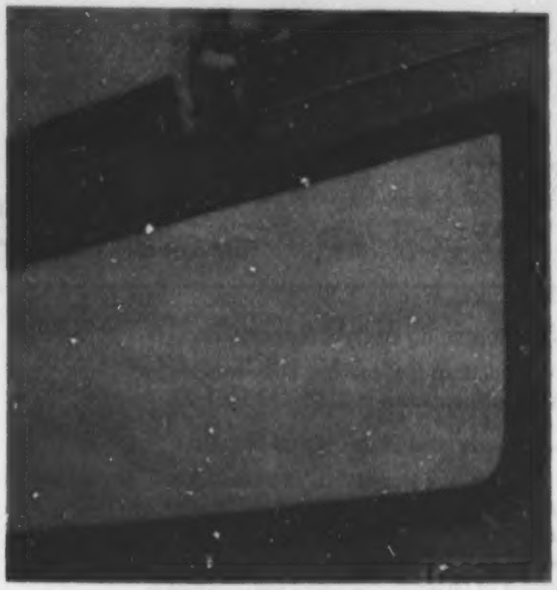


Figure 8-5. Weatherstrip Installation.

8-5. Fender Installation.

a. The fender sheet metal attaches directly to the cab. Use spacers between the rear of the fender and the cowl; this alines the sheet metal at the cowl vent opening and grille. Refer to figure 8-6.

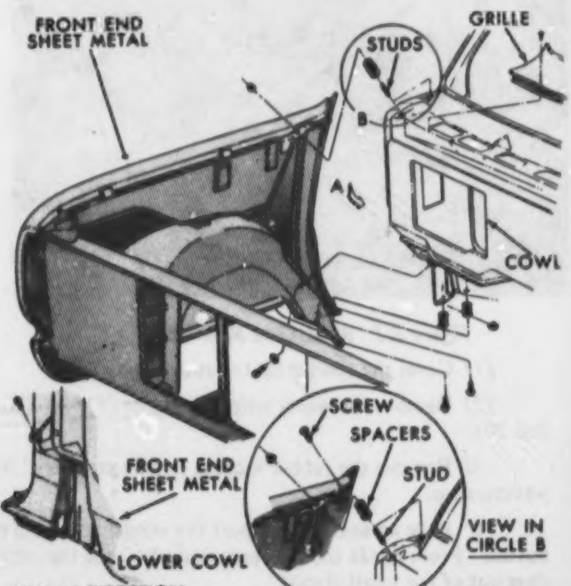

FRONT END SHEET METAL
STUDS
GRILLE
B
A
COWL
SCREW
SPACERS
FRONT END SHEET METAL
STUD
VIEW IN CIRCLE B
LOWER COWL
VIEW IN DIRECTION OF ARROW A
TA029206

Figure 8-6. Fender to Cab and Cowl Grille.

b. Mount the fender end on the cab sheet metal, using either of the following mounting methods:

(1) Use two studs.

(2) Use a stud on the lower mounting and a screw and washer in the top mounting.

c. Spacers may be used with either attaching method. If so, be sure to use the same amount of spacers that were removed during disassembly of the front end.

8-6. Removing and Installing the Cargo Box.

a. Remove the attaching bolts.

b. Disconnect taillight and backup light wires.

c. Lift off the cargo box.

d. To install, reverse the above procedure.

8-7. Removing and Installing the Telephone Maintenance Body.

a. Remove the four attaching nuts and washers.

b. Disconnect taillight and backup light wires.

c. Lift the maintenance body off, using the ladder loops.

d. Position body.

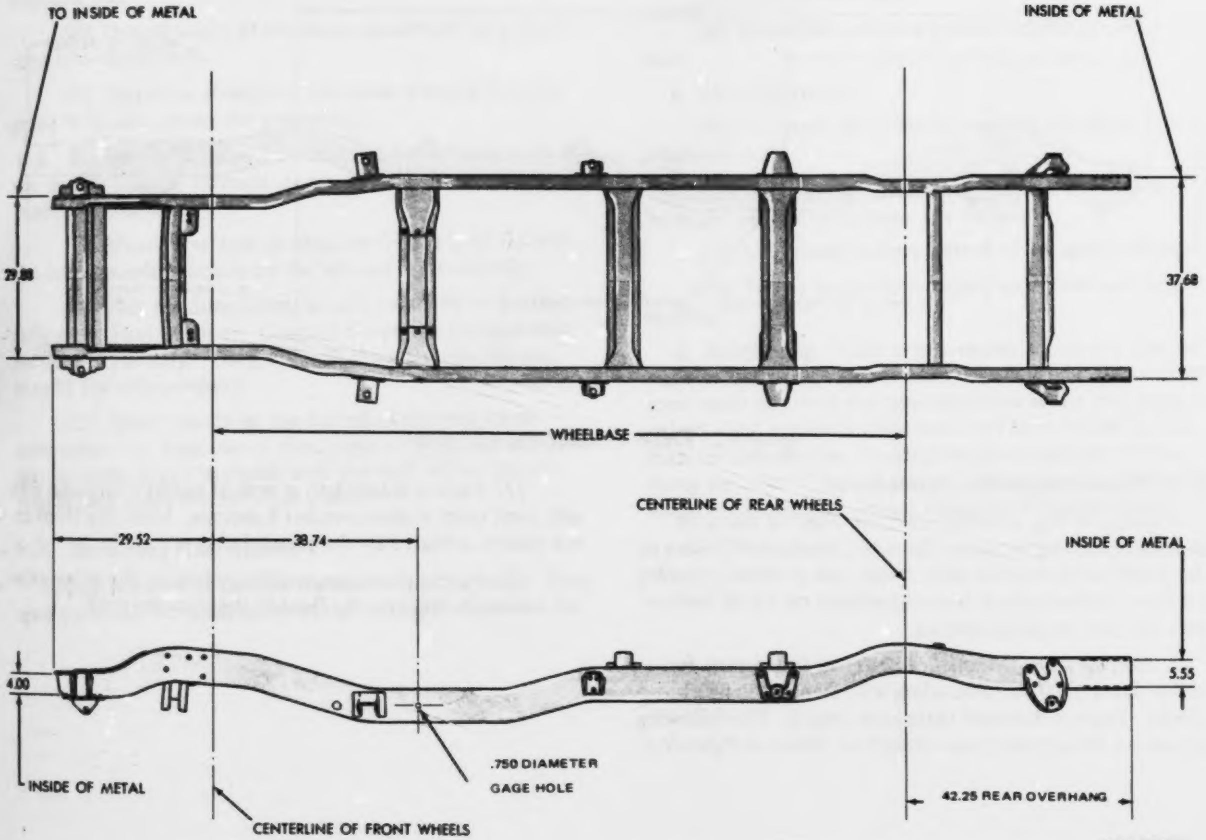
e. Connect taillight and backup light wires.

f. Install four attaching nuts and washers.

CHAPTER 9
REPAIR OF FRAME STRUCTURES

9-1. Description and Data.

The truck frame provides support for the body mounting and all chassis components. It also carries the payload while keeping deflections at a tolerable level. The frame reacts to applied loads and road input by flexing and twisting. The main flex members are the siderails. Crossmembers, attached to the siderails to form the "ladder-type" frame, minimize twisting. Refer to figures 9-1 and 9-2 for frame dimensions.


TO INSIDE OF METAL
INSIDE OF METAL
29.88
37.68
WHEELBASE
CENTERLINE OF REAR WHEELS
INSIDE OF METAL
29.52
38.74
4.00
5.55
.750 DIAMETER
GAGE HOLE
INSIDE OF METAL
42.25 REAR OVERHANG
CENTERLINE OF FRONT WHEELS

TA028955

Figure 9-1. Frame Dimensions, 4X4 Model.

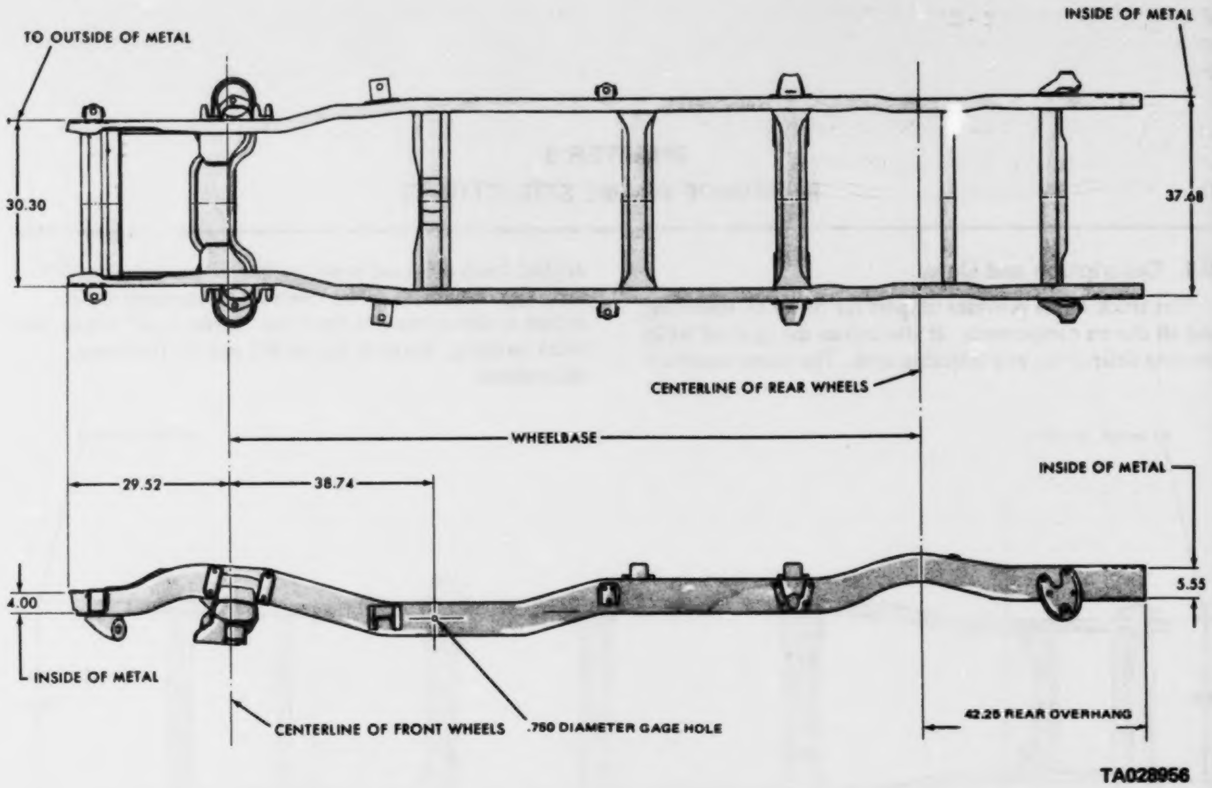

TO OUTSIDE OF METAL
INSIDE OF METAL
30.30
37.68
CENTERLINE OF REAR WHEELS
WHEELBASE
29.52
38.74
INSIDE OF METAL
4.00
5.55
INSIDE OF METAL
CENTERLINE OF FRONT WHEELS
.750 DIAMETER GAGE HOLE
42.25 REAR OVERHANG
TA028956

Figure 9-2. Frame Dimensions, 4X2 Model.

9-2. Frame Inspection Procedures.

A distorted frame will affect front wheel or rear axle alinement, causing excessive tire wear, mechanical failure in the power train, window glass cracks, and problems opening the door. Always check frame alinement on a level surface with the tires properly inflated.

a. Horizontal or Diagonal. Inspect all frame parts for visible damage before proceeding with frame alinement checks. Replace damaged parts as necessary. The following procedure determines frame distortion. Refer to figure 9-3.

(1) Place a plumb bob at several points along one siderail, preferably at crossmember locations. Mark the floor at the points indicated by the plumb bob.

(2) Locate the corresponding points on the other siderail and mark them on the floor in the same manner.

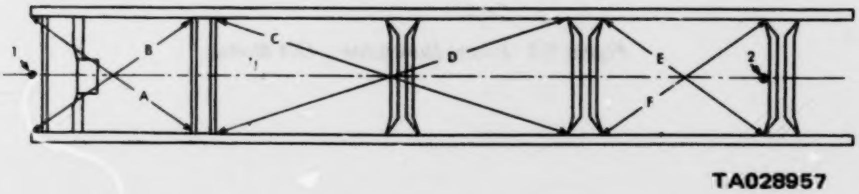

1
B
C
A
D
E
F
2
TA028957

Figure 9-3. Alinement Marking.

(3) Move the truck. Measure and mark lines between all marks, diagonally and parallel to the siderails. Corresponding measurements should not differ by more than a quarter of an inch.

(4) Measure the width at the front and rear marks. Divide the distance in half to determine the center points.

(5) Stretch a chalk line between points 1 and 2 in figure 9-3 and snap the line.

(6) Measure the distances from the centerline to the diagonal intersections (points A, B, C, D, E, and F in figure 9-3). This will tell you if the frame is bent to the right or left. The distance should not exceed one-eighth inch per 100 inches of frame.

(7) Any point on one siderail should be within one-eighth inch above or below the corresponding point on the opposite side.

(8) Overall width of the frame should not vary more than one-eighth inch.

(9) Service or straighten the frame if required (paragraph 9-3), and repeat the procedure.

b. *Vertical or Sideview.* To determine the frame twist or the degree that the siderails are not parallel to one another, proceed as follows:

(1) Measure vertical dimensions from a level floor to the corresponding points on the left and right siderails.

(2) Plot the dimensions to scale vertically or horizontally on a sheet of paper. Connect the points for each sidemember separately. The graph will show the relative position of the sidemembers.

(3) Select points on the siderail at the rear frame crossmembers. Any one of these points on one siderail must not be more than one-eighth inch above or below the corresponding point on the other siderail.

9-3. Servicing the Frame.

Straighten bent or twisted frames by applying heat. Damaged parts can be repaired by straightening, or can be replaced. Welded connections between rails and crossmembers are not recommended.

a. *Straightening.* Limit straightening to parts not severely bent. Replace the part if its original shape is not easily recognizable.

b. *Welding (4X2 Models Only).*

Use electric welding equipment when welding to the siderails or crossmembers. This retains heat in a small area, limiting the change of hardness of the metal. Inspect a damaged frame for cracks. Repair any cracks as follows:

(1) Stop-drill at the end point of the crack with a 1/8-inch drill.

(2) V-groove the crack to allow good weld penetration.

(3) Weld up the crack.

(4) Grind the surface smooth if reinforcement is to be used.

c. *Use of Fasteners.*

(1) Use grade five bolts in repairing frames or adding reinforcement.

(2) When substituting a bolt for a rivet, ream the hole and use the next larger size bolt.

(3) Use coned washers instead of the split-lock type.

(4) Proper torque is necessary to provide adequate locking.

d. *Reinforcing.* Make reinforcements from the channel angle or flat stock of a common carbon steel. The reinforcement must be about the same thickness as the part being repaired. The reinforcing channel must have flanges shorter than the sidemember flanges; this guards against welding along the edge of the rail flange. Otherwise, longitudinal welds are acceptable. Avoid complete transverse welds.

CHAPTER 10
REPAIR OF THE ELECTRICAL SYSTEM

10-1. Battery, Lights, Switches, Gages, and Sending Units.

Procedures for testing, inspecting, removing, and installing the battery, lights, switches, gages, and sending units are contained in TM 9-2320-266-20. See paragraph 10-3 for replacing the ignition switch when the steering column is installed in the truck.

10-2. Repair of Cables and Wiring Harness.

To locate a problem in the wiring, use the wiring diagrams (figures 10-1 through 10-1.5). Check especially at connectors for opens. If a problem is located in the wiring harness, the harness should be repaired on the truck by replacing only the damaged wire or wires.

10-3. Removing and Replacing the Ignition Switch.

a. General. The following procedures are used when replacing the ignition switch while the steering column is still in the vehicle. Procedures for repairing the entire steering column, including the ignition switch, after the column is removed from the truck, may be found in paragraph 21-5.

b. Replacing the Cylinder Lock. Disconnect the negative (ground) cable at the battery prior to starting this procedure.

(1) Remove the steering wheel (see TM 9-2320-266-20).

(2) Drive out the gear selector lever pin, then remove the lever and spring from the housing.

(3) Remove the turn signal lever.

(4) Remove the upper bearing retainer screws. Remove the retainer and lift the turn signal switch out of the way (figure 10-2).

(5) Remove the two retaining screws and lift the lamp assembly out of the way.

(6) Remove the snap ring from the upper end of the steering shaft (figure 10-3).

(7) Remove the three screws which hold the bearing housing to the lock housing.

(8) Install the steering shaft remover C-4044 and press the bearing housing off the shaft (figure 10-4).

(9) Place the cylinder in the LOCK position and remove the key. Insert a small diameter screwdriver or similar tool into the lock cylinder release hole. Push it in to release the spring-loaded lock retainer. At the same time, pull the lock cylinder out of the housing bore (figure 10-5).

(10) If the ignition switch is damaged, replace it (*c*, below). Otherwise, replace the lock cylinder as follows:

(a) Install the cylinder lock in the housing.

(b) Insert the key and turn the cylinder until you hear it latch into place in the housing.

(c) Reassemble the steering column (*e*, below).

c. Replacing the Ignition Switch. Replace the ignition switch if it is badly worn or its attached wiring harness is damaged.

(1) Remove the harness cover at the steering column.

(2) Disconnect one, 8 cavity connector and one, 2 cavity connector (figure 10-2.1)

NOTE

There are two orange wires. Remove the wire which goes to the automatic transmission indicator light.

(3) Remove the 18 gage orange wire from connector (figure 10-2.1).

(4) Remove the shift indicator and lamp assembly.

(5) Remove the three retaining screws and pull the ignition switch outward from the steering column, straighten the attached wires and guide the wires up through the steering column.

(6) Maneuver the wiring harness connectors and wires up through the steering column opening to complete removal of the ignition switch.

(7) For the replacement package for the ignition switch, cut the terminals off from black and red wires on the ignition switch harness. Strip wire ends back 3/16 inch. Install the two new terminals found in the hardware kit. Crimp firmly to wires (figure 10-2.2).

(8) Plug the black and red wires into new connector block found in the hardware kit. Make sure that the black and red wires are in correct location in connector block (figure 10-2.2).

(9) Maneuver wiring harness through the opening in the column.

(10) Install ignition switch in the steering column and secure with 3 screws.

(11) Connect one, 8 cavity connector and one 2 cavity connector (figure 10-2.1).

(12) Install the 18 gage orange wire from the automatic transmission indicator light to No. 8 cavity (figure 10-2.1).

(13) Install harness cover at the steering column.

(14) Reassemble the steering column (*e*, below).

d. *Replacing the Cylinder Lock Housing.* Replace the housing if it is badly worn.

(1) Remove the ignition switch (c, above).

(2) Remove the four lock-housing-to-column jacket retaining screws (figure 10-6).

(3) Pull the housing outward from the steering column.

(4) Install the housing in the steering column and secure with four lock housing to column jacket retaining screws (figure 10-6).

(5) Install the ignition switch (c, above).

e. *Reassembling the Steering Column.*

(1) Press the bearing housing onto the shaft, using tool C-3879.

(2) Install the three screws which hold the bearing housing to the lock housing.

(3) Install the snap ring at the upper end of the steering shaft (figure 10-3).

(4) Position the lamp assembly and attach the two retaining screws.

(5) Position the turn signal lever and the retainer and attach with the upper bearing retainer screws.

(6) Install the turn signal lever (figure 10-2).

(7) Install the gear selector lever and spring in the housing. Attach with the gear selector lever pin.

(8) Install the steering wheel (see TM 9-2320-266-20).

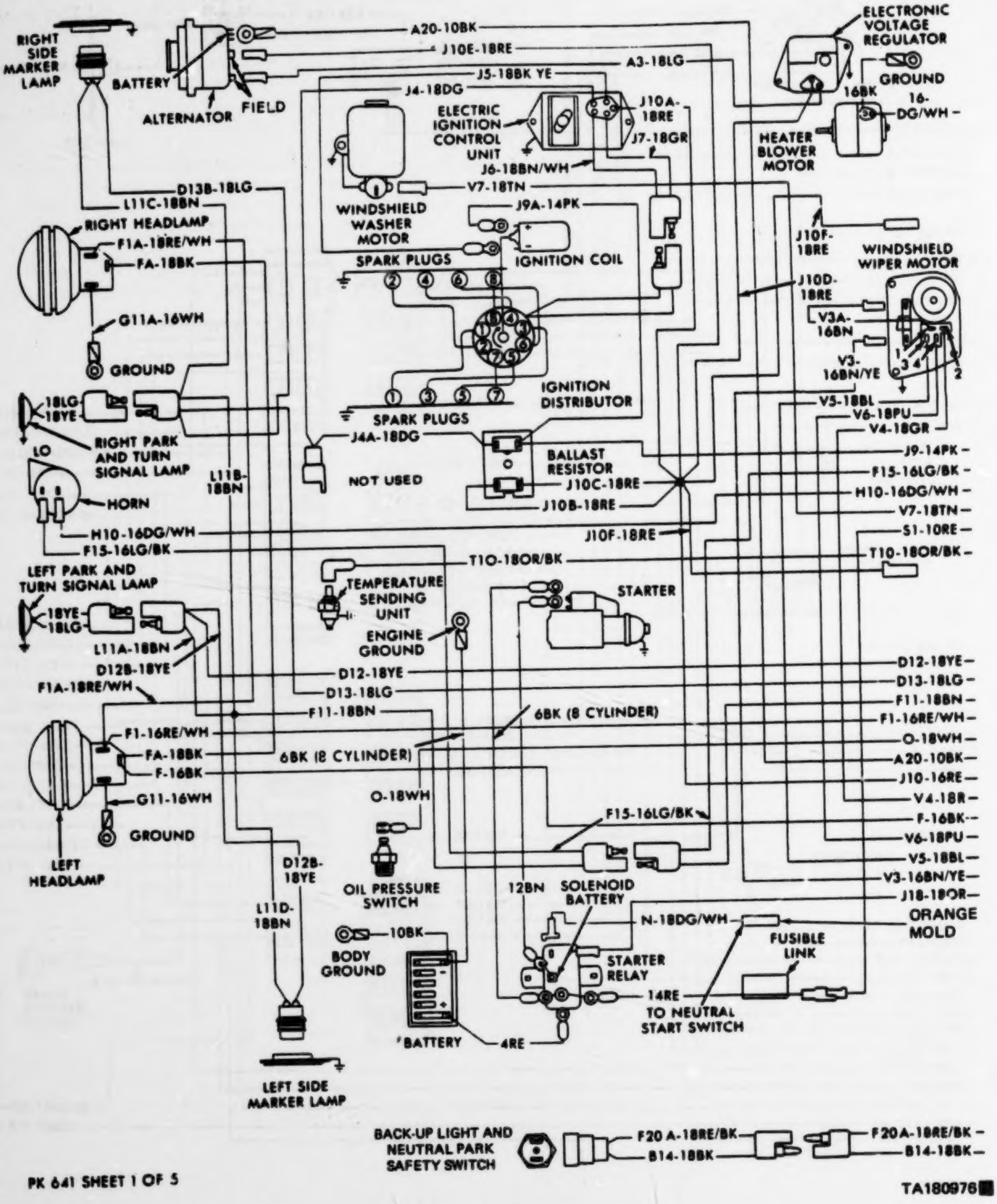
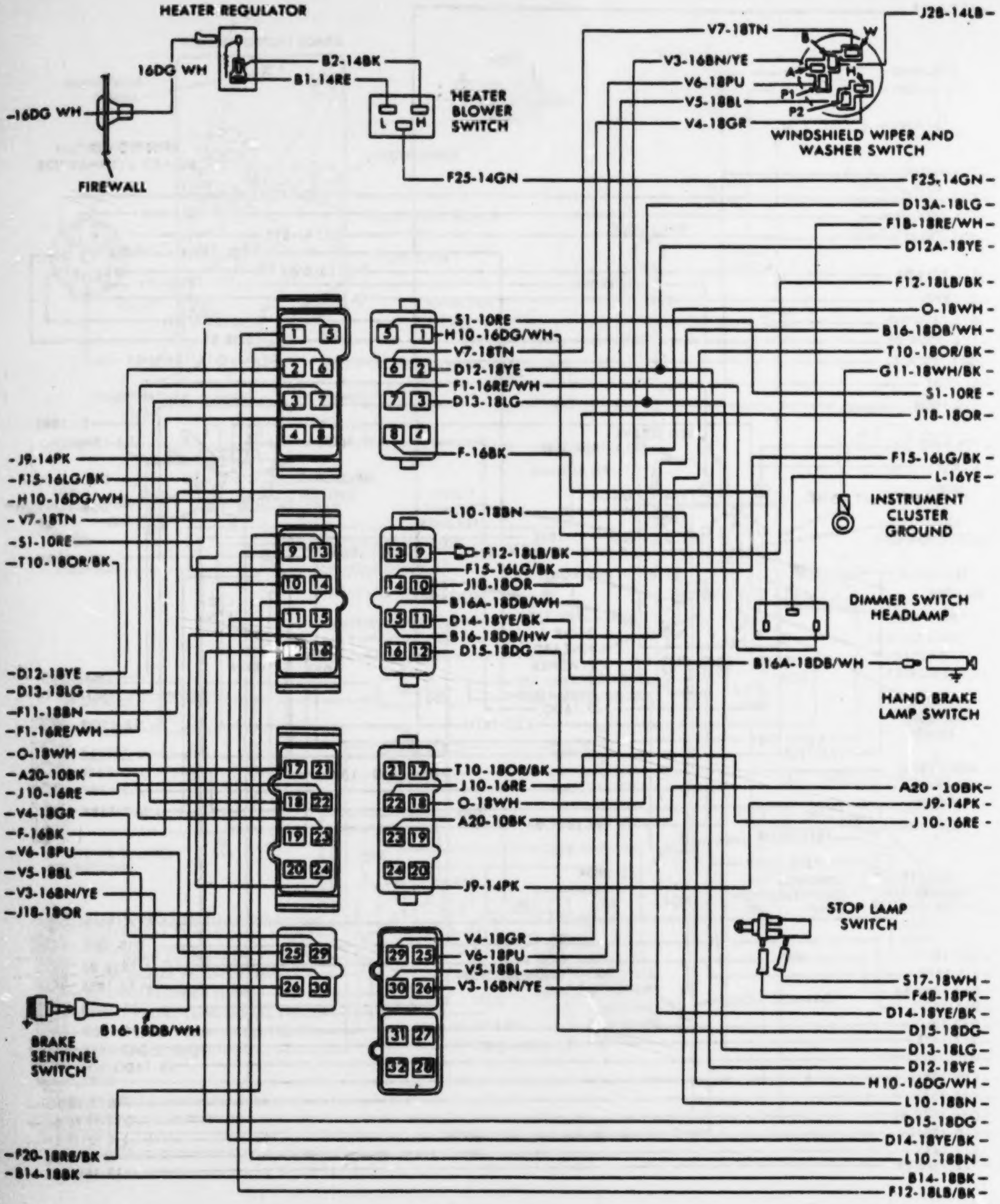
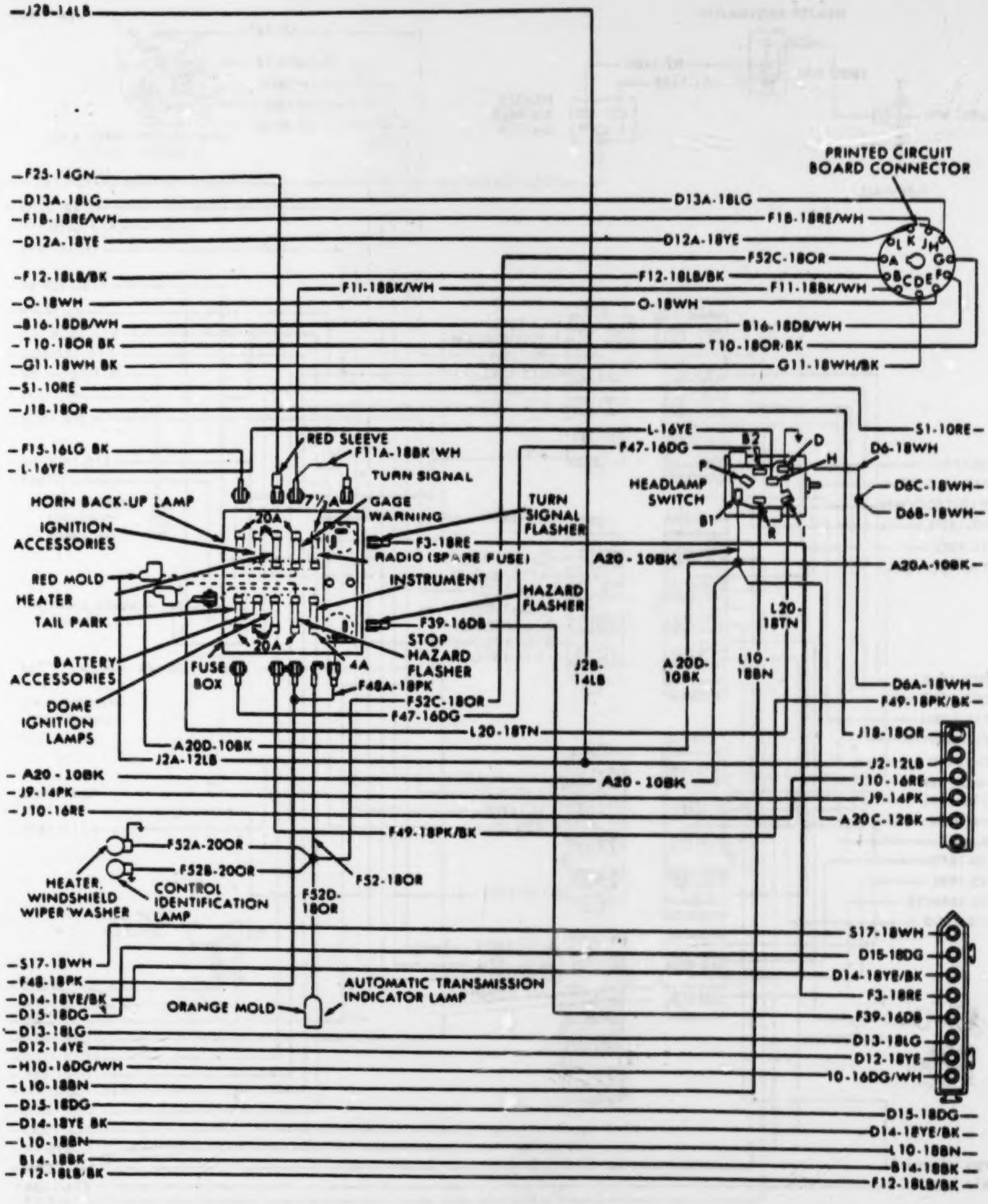

RIGHT SIDE MARKER LAMP
BATTERY
ALTERNATOR
FIELD
A20-10BK
J10E-18RE
A3-18LG
J5-18BK YE
J4-18DG
ELECTRONIC VOLTAGE REGULATOR
GROUND
16BK
16-DG/WH
HEATER BLOWER MOTOR
ELECTRIC IGNITION CONTROL UNIT
J10A-18RE
J7-18GR
J6-18BN/WH
V7-18TN
WINDSHIELD WASHER MOTOR
D13B-18LG
L11C-18BN
J9A-14PK
IGNITION COIL
SPARK PLUGS
J10F-18RE
WINDSHIELD WIPER MOTOR
J10D-18RE
V3A-16BN
V3-16BN/YE
1
2
3
4
RIGHT HEADLAMP
F1A-18RE/WH
FA-18BK
G11A-16WH
GROUND
IGNITION DISTRIBUTOR
18LG
18YE
RIGHT PARK AND TURN SIGNAL LAMP
LO
HORN
L11B-18BN
J4A-18DG
NOT USED
BALLAST RESISTOR
J10C-18RE
J10B-18RE
V5-18BL
V6-18PU
V4-18GR
J9-14PK
F15-16LG/BK
H10-16DG/WH
V7-18TN
S1-10RE
T10-18OR/BK
H10-16DG/WH
F15-16LG/BK
J10F-18RE
LEFT PARK AND TURN SIGNAL LAMP
T10-18OR/BK
TEMPERATURE SENDING UNIT
STARTER
ENGINE GROUND
18YE
18LG
L11A-18BN
D12B-18YE
F1A-18RE/WH
D12-18YE
D13-18LG
F11-18BN
6BK (8 CYLINDER)
6BK (8 CYLINDER)
D12-18YE
D13-18LG
F11-18BN
F1-16RE/WH
O-18WH
A20-10BK
J10-16RE
V4-18R
F-16BK
V6-18PU
V5-18BL
V3-16BN/YE
J18-18OR
F1-16RE/WH
FA-18BK
F-16BK
G11-16WH
GROUND
LEFT HEADLAMP
O-18WH
F15-16LG/BK
OIL PRESSURE SWITCH
D12B-18YE
L11D-18BN
12BN
SOLENOID BATTERY
N-18DG/WH
ORANGE MOLD
FUSIBLE LINK
10BK
BODY GROUND
STARTER RELAY
14RE
TO NEUTRAL START SWITCH
BATTERY
4RE
LEFT SIDE MARKER LAMP
BACK-UP LIGHT AND NEUTRAL PARK SAFETY SWITCH
F20 A-18RE/BK
B14-18BK
F20A-18RE/BK
B14-18BK
PK 641 SHEET 1 OF 5
TA180976

Figure 10-1. Wiring Diagram (1 of 5)


HEATER REGULATOR
16DG WH
-16DG WH
FIREWALL
B2-14BK
B1-14RE
L
H
HEATER BLOWER SWITCH
F25-14GN
V7-18TN
J28-14LB -
B
W
V3-16BN/YE
V6-18PU
V5-18BL
V4-18GR
A
H
P1
P2
WINDSHIELD WIPER AND WASHER SWITCH
F25-14GN -
D13A-18LG -
F18-18RE/WH -
D12A-18YE -
F12-18LB/BK -
O-18WH -
B16-18DB/WH -
T10-18OR/BK -
G11-18WH/BK -
S1-10RE -
J18-18OR -
F15-16LG/BK -
L-16YE -
INSTRUMENT CLUSTER GROUND
DIMMER SWITCH HEADLAMP
B16A-18DB/WH
HAND BRAKE LAMP SWITCH
1
5
2
6
3
7
4
8
S1-10RE
H10-16DG/WH
V7-18TN
D12-18YE
F1-16RE/WH
D13-18LG
F-16BK
- J9-14PK
-F15-16LG/BK
-H10-16DG/WH
- V7-18TN
-S1-10RE
-T10-18OR/BK
9
13
10
14
11
15
12
16
L10-18BN
F12-18LB/BK
F15-16LG/BK
J18-18OR
B16A-18DB/WH
D14-18YE/BK
B16-18DB/HW
D15-18DG
-D12-18YE
-D13-18LG
-F11-18BN
-F1-16RE/WH
-O-18WH
-A20-10BK
-J10-16RE
-V4-18GR
-F-16BK
-V6-18PU
-V5-18BL
-V3-16BN/YE
-J18-18OR
17
21
18
22
19
23
20
24
T10-18OR/BK
J10-16RE
O-18WH
A20-10BK
J9-14PK
A20 - 10BK -
J9-14PK -
J10-16RE -
STOP LAMP SWITCH
25
29
26
30
V4-18GR
V6-18PU
V5-18BL
V3-16BN/YE
31
27
32
28
B16-18DB/WH
BRAKE SENTINEL SWITCH
S17-18WH -
F48-18PK -
D14-18YE/BK -
D15-18DG -
D13-18LG -
D12-18YE -
H10-16DG/WH -
L10-18BN -
D15-18DG -
D14-18YE/BK -
L10-18BN -
B14-18BK -
F12-18LB/BK -
-F20-18RE/BK
-B14-18BK

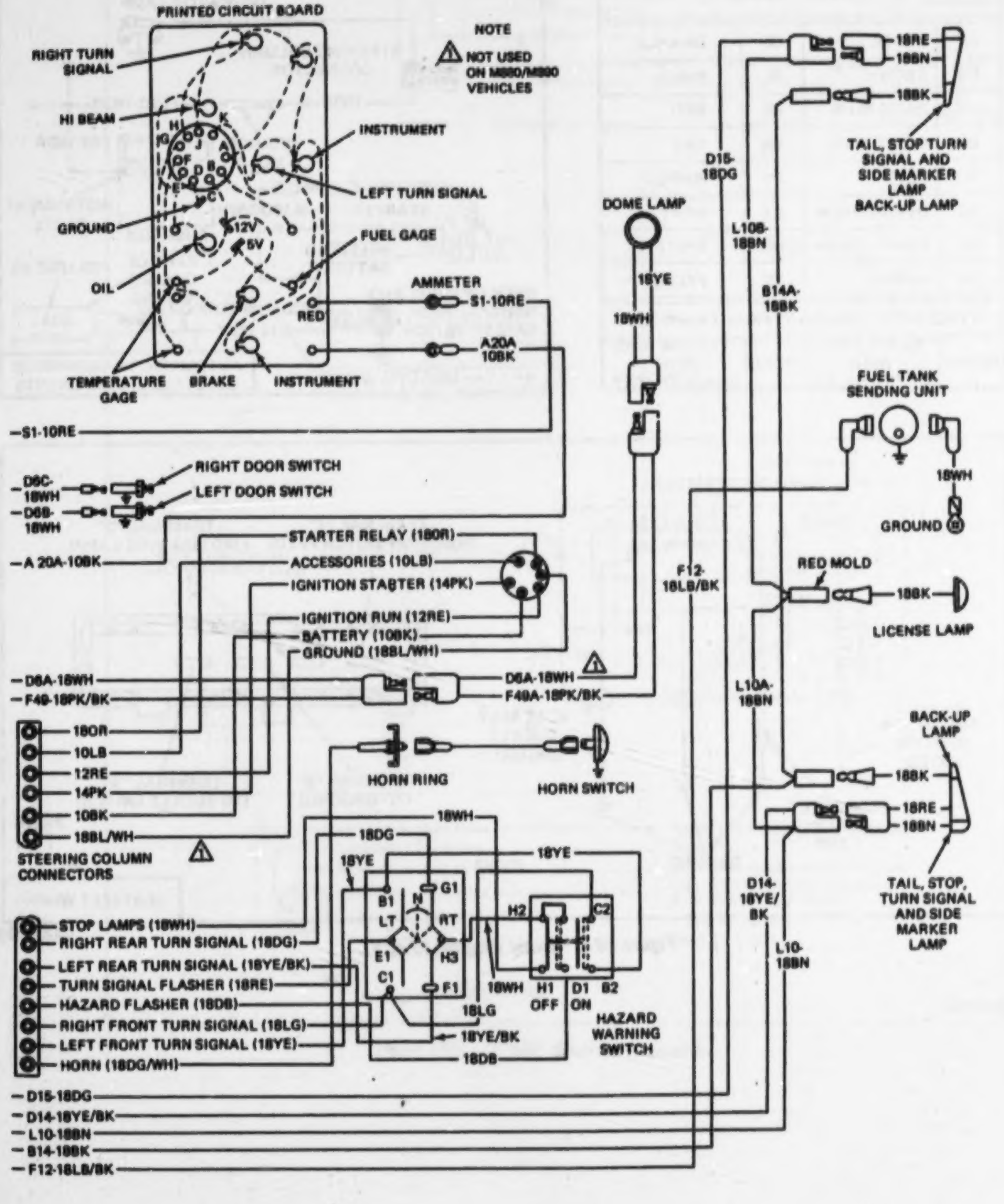
TA234967

Figure 10-1. Wiring Diagram (2 of 5).


J28-14LB
F25-14GN
D13A-18LG
F18-18RE/WH
D12A-18YE
F12-18LB/BK
O-18WH
B16-18DB/WH
T10-18OR BK
G11-18WH BK
S1-10RE
J18-18OR
F15-16LG BK
L-16YE
PRINTED CIRCUIT BOARD CONNECTOR
D13A-18LG
F18-18RE/WH
D12A-18YE
F52C-18OR
F12-18LB/BK
F11-18BK/WH
O-18WH
B16-18DB/WH
T10-18OR BK
G11-18WH/BK
S1-10RE
L-16YE
F47-16DG
D6-18WH
D6C-18WH
D6B-18WH
HEADLAMP SWITCH
B2
D
H
P
B1
R
I
A20 - 10BK
A20A-10BK
L20-18TN
L10-18BN
A20D-10BK
J28-14LB
D6A-18WH
F49-18PK/BK
J18-18OR
J2-12LB
J10-16RE
J9-14PK
A20C-12BK
RED SLEEVE
F11A-18BK WH
TURN SIGNAL
HORN BACK-UP LAMP
7½A
GAGE WARNING
20A
TURN SIGNAL FLASHER
IGNITION ACCESSORIES
F3-18RE
RADIO (SPARE FUSE)
RED MOLD
INSTRUMENT
HEATER
HAZARD FLASHER
TAIL PARK
F39-16DB
20A
STOP
HAZARD FLASHER
4A
BATTERY ACCESSORIES
FUSE BOX
F48A-18PK
F52C-18OR
F47-16DG
L20-18TN
DOME IGNITION LAMPS
A20D-10BK
J2A-12LB
A20 - 10BK
J9-14PK
J10-16RE
A20 - 10BK
F49-18PK/BK
F52A-20OR
F52B-20OR
F52-18OR
HEATER, WINDSHIELD WIPER WASHER
CONTROL IDENTIFICATION LAMP
F52D-18OR
S17-18WH
F48-18PK
D14-18YE/BK
D15-18DG
AUTOMATIC TRANSMISSION INDICATOR LAMP
ORANGE MOLD
D13-18LG
D12-14YE
H10-16DG/WH
L10-18BN
D15-18DG
D14-18YE BK
L10-18BN
B14-18BK
F12-18LB/BK
S17-18WH
D15-18DG
D14-18YE/BK
F3-18RE
F39-16DB
D13-18LG
D12-18YE
10-16DG/WH
D15-18DG
D14-18YE/BK
L10-18BN
B14-18BK
F12-18LB/BK

TA234968

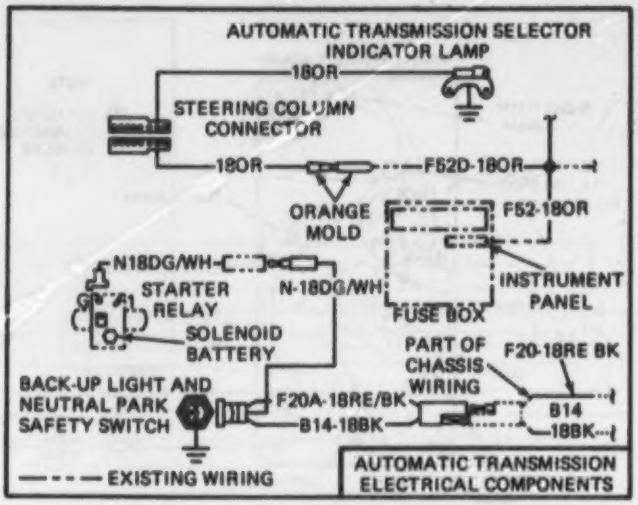
Figure 10-1. Wiring Diagram (3 of 5)

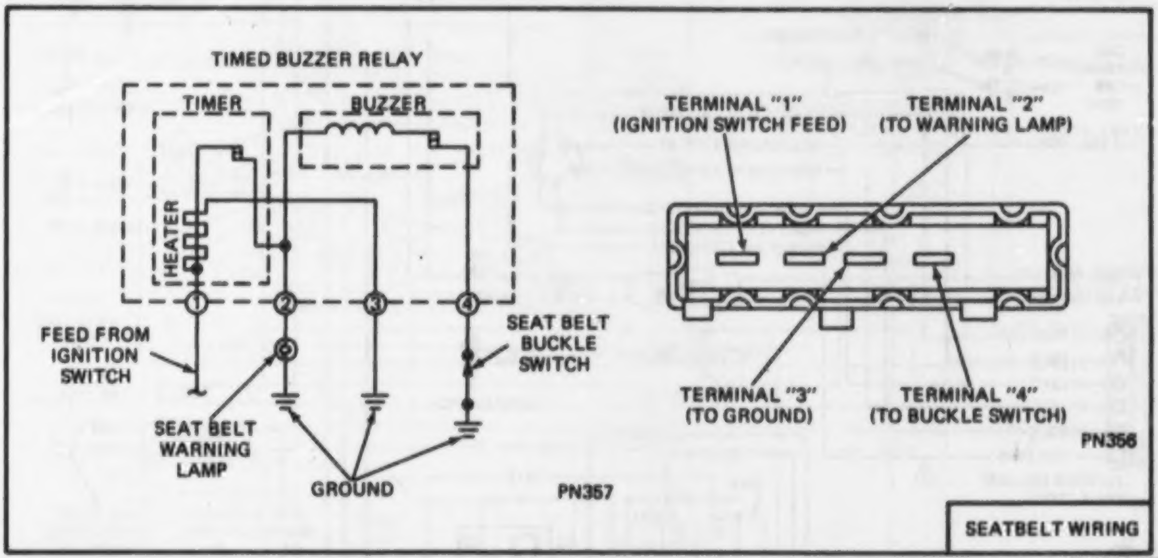

PRINTED CIRCUIT BOARD
RIGHT TURN SIGNAL
HI BEAM
INSTRUMENT
LEFT TURN SIGNAL
GROUND
FUEL GAGE
OIL
12V
5V
AMMETER
S1-10RE
RED
A20A 10BK
TEMPERATURE GAGE
BRAKE
INSTRUMENT
NOTE
⚠ NOT USED ON M880/M890 VEHICLES
-S1-10RE
RIGHT DOOR SWITCH
LEFT DOOR SWITCH
-D6C-18WH
-D6B-18WH
STARTER RELAY (18OR)
-A 20A-10BK
ACCESSORIES (10LB)
IGNITION STARTER (14PK)
IGNITION RUN (12RE)
BATTERY (10BK)
GROUND (18BL/WH)
-D6A-18WH
-F49-18PK/BK
D6A-18WH
F49A-18PK/BK
18OR
10LB
12RE
14PK
10BK
18BL/WH
STEERING COLUMN CONNECTORS
HORN RING
HORN SWITCH
18WH
18DG
18YE
18YE
B1
G1
N
LT
RT
E1
H3
C1
F1
H2
C2
18WH
H1 OFF
D1 ON
B2
18LG
18YE/BK
18DB
HAZARD WARNING SWITCH
STOP LAMPS (18WH)
RIGHT REAR TURN SIGNAL (18DG)
LEFT REAR TURN SIGNAL (18YE/BK)
TURN SIGNAL FLASHER (18RE)
HAZARD FLASHER (18DB)
RIGHT FRONT TURN SIGNAL (18LG)
LEFT FRONT TURN SIGNAL (18YE)
HORN (18DG/WH)
-D15-18DG
-D14-18YE/BK
-L10-18BN
-B14-18BK
-F12-18LB/BK
DOME LAMP
18YE
18WH
D15-18DG
L10B-18BN
B14A-18BK
F12-18LB/BK
L10A-18BN
D14-18YE/BK
L10-18BN
18RE
18BN
18BK
TAIL, STOP TURN SIGNAL AND SIDE MARKER LAMP BACK-UP LAMP
FUEL TANK SENDING UNIT
18WH
GROUND
RED MOLD
18BK
LICENSE LAMP
BACK-UP LAMP
18BK
18RE
18BN
TAIL, STOP, TURN SIGNAL AND SIDE MARKER LAMP

TA180919

Figure 10-1. Wiring Diagram (4 of 5).

COLOR CODE			
BK	BLACK	OR	ORANGE
BN	BROWN	PK	PINK
DB	DARK BLUE	RE	RED
LB	LIGHT BLUE	TN	TAN
BL	BLUE	PU	PURPLE
DG	DARK GREEN	GR	GRAY
LG	LIGHT GREEN	WH	WHITE
GN	GREEN	YE	YELLOW
WIRES WITH TRACERS TYPICAL EXAMPLES			
BK/WH	BLACK WIRE WITH WHITE TRACER	YE/BK	YELLOW WIRE WITH BLACK TRACER


AUTOMATIC TRANSMISSION SELECTOR INDICATOR LAMP
18OR
STEERING COLUMN CONNECTOR
18OR
F52D-18OR
ORANGE MOLD
F52-18OR
N18DG/WH
STARTER RELAY
N-18DG/WH
INSTRUMENT PANEL
FUSE BOX
SOLENOID BATTERY
PART OF CHASSIS WIRING
F20-18RE BK
BACK-UP LIGHT AND NEUTRAL PARK SAFETY SWITCH
F20A-18RE/BK
B14
B14-18BK
18BK
EXISTING WIRING
AUTOMATIC TRANSMISSION ELECTRICAL COMPONENTS


TIMED BUZZER RELAY
TIMER
BUZZER
HEATER
1
2
3
4
FEED FROM IGNITION SWITCH
SEAT BELT WARNING LAMP
GROUND
SEAT BELT BUCKLE SWITCH
PN357
TERMINAL "1" (IGNITION SWITCH FEED)
TERMINAL "2" (TO WARNING LAMP)
TERMINAL "3" (TO GROUND)
TERMINAL "4" (TO BUCKLE SWITCH)
PN356
SEATBELT WIRING

TA204123

Figure 10-1. Wiring Diagram (5 of 5).

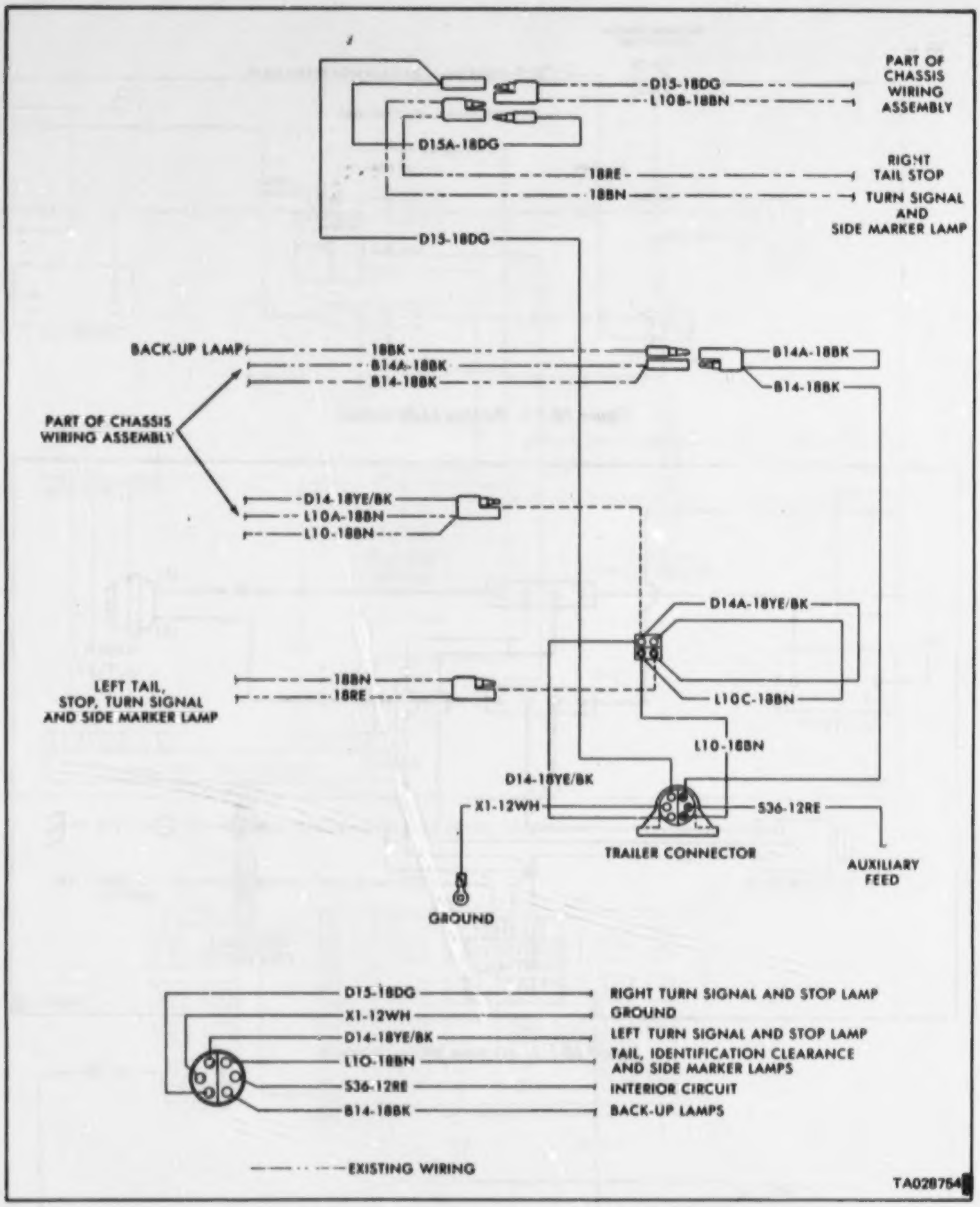

PART OF CHASSIS WIRING ASSEMBLY
D15-18DG
L10B-18BN
D15A-18DG
RIGHT TAIL STOP
18RE
18BN
TURN SIGNAL AND SIDE MARKER LAMP
D15-18DG
BACK-UP LAMP
18BK
B14A-18BK
B14-18BK
B14A-18BK
B14-18BK
PART OF CHASSIS WIRING ASSEMBLY
D14-18YE/BK
L10A-18BN
L10-18BN
D14A-18YE/BK
LEFT TAIL, STOP, TURN SIGNAL AND SIDE MARKER LAMP
18BN
18RE
L10C-18BN
L10-18BN
D14-18YE/BK
X1-12WH
S36-12RE
TRAILER CONNECTOR
AUXILIARY FEED
GROUND
D15-18DG — RIGHT TURN SIGNAL AND STOP LAMP
X1-12WH — GROUND
D14-18YE/BK — LEFT TURN SIGNAL AND STOP LAMP
L10-18BN — TAIL, IDENTIFICATION CLEARANCE AND SIDE MARKER LAMPS
S36-12RE — INTERIOR CIRCUIT
B14-18BK — BACK-UP LAMPS
EXISTING WIRING
TA028754

Figure 10-1.1. Trailer Electrical Recepticle.

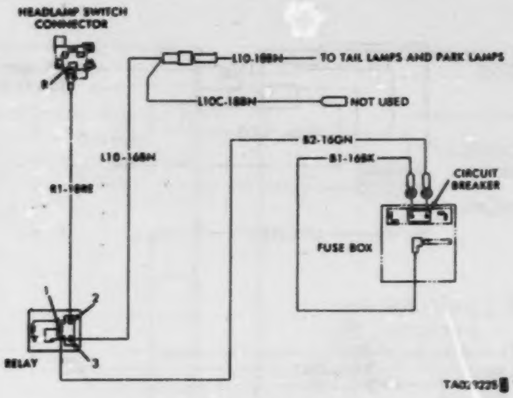

HEADLAMP SWITCH CONNECTOR
B
L10-18BN
TO TAIL LAMPS AND PARK LAMPS
L10C-18BN
NOT USED
L10-16BN
B1-16RE
B2-16GN
B1-16BK
CIRCUIT BREAKER
FUSE BOX
1
2
3
RELAY

Figure 10-1.2. Parking Light Circuit.

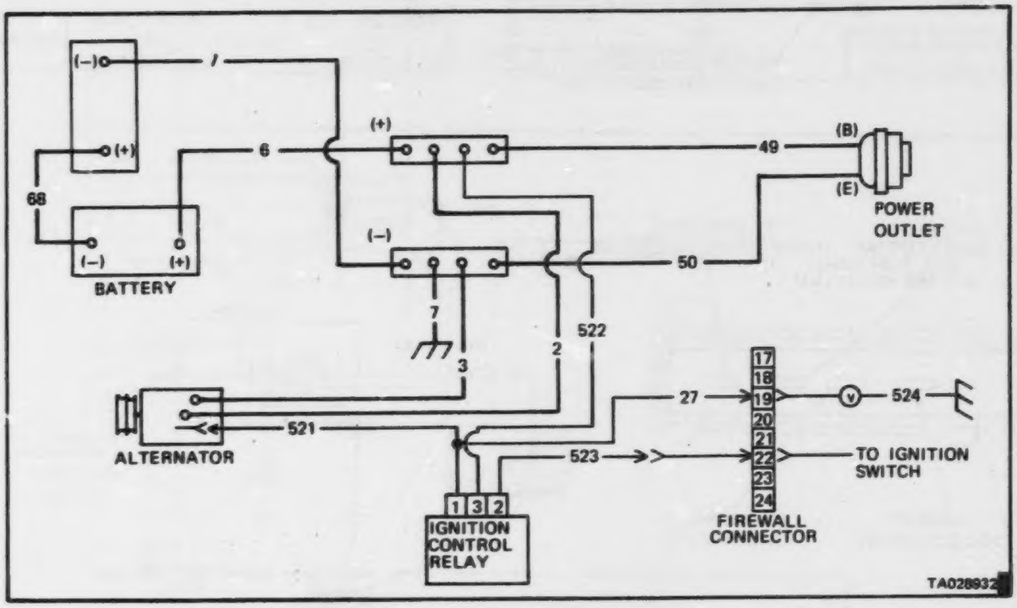

(–)
(+)
1
6
68
(–)
(+)
BATTERY
(+)
(–)
49
(B)
(E)
POWER OUTLET
50
7
3
2
522
ALTERNATOR
521
27
524
523
17
18
19
20
21
22
23
24
TO IGNITION SWITCH
FIREWALL CONNECTOR
1
3
2
IGNITION CONTROL RELAY
TA028932

Figure 10-1.3. 60-Amp Wiring Diagram.

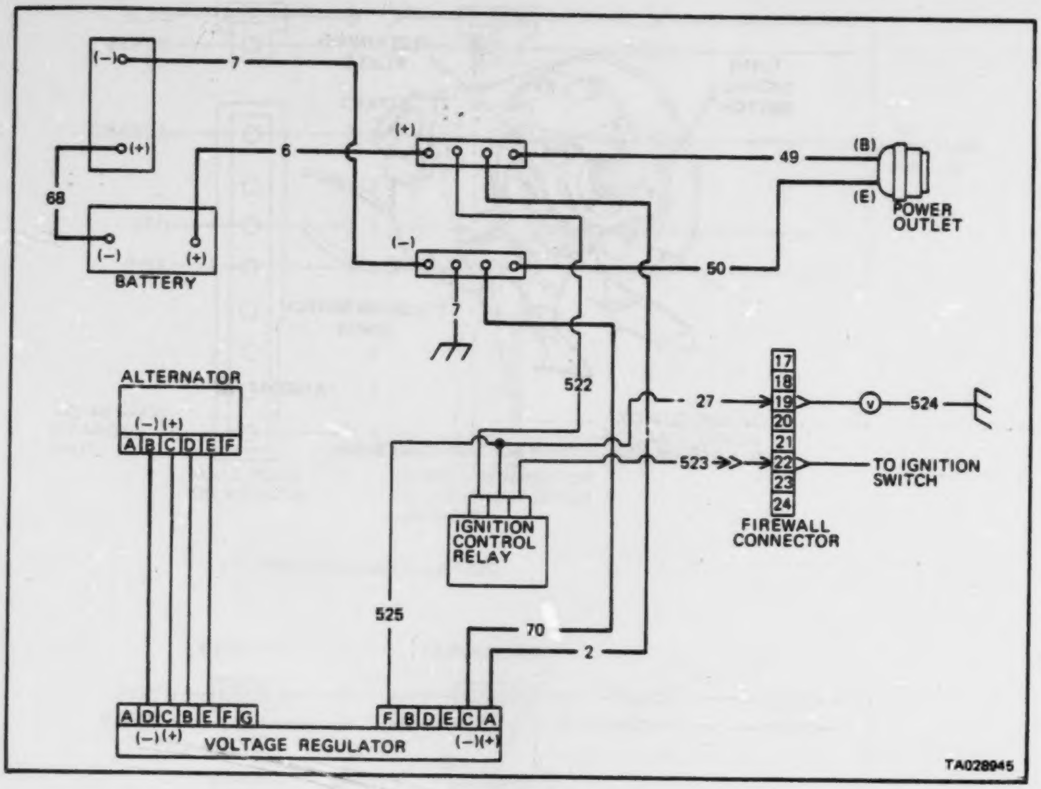

(–)
7
(+)
6
68
(–)
(+)
BATTERY
(+)
(–)
49
(B)
(E)
POWER OUTLET
50
7
522
ALTERNATOR
(–) (+)
A B C D E F
17
18
19
20
21
22
23
24
27
V
524
523
TO IGNITION SWITCH
FIREWALL CONNECTOR
IGNITION CONTROL RELAY
525
70
2
A D C B E F G
(–) (+)
VOLTAGE REGULATOR
F B D E C A
(–) (+)
TA028945

Figure 10-1.4. 100-Amp Wiring Diagram.

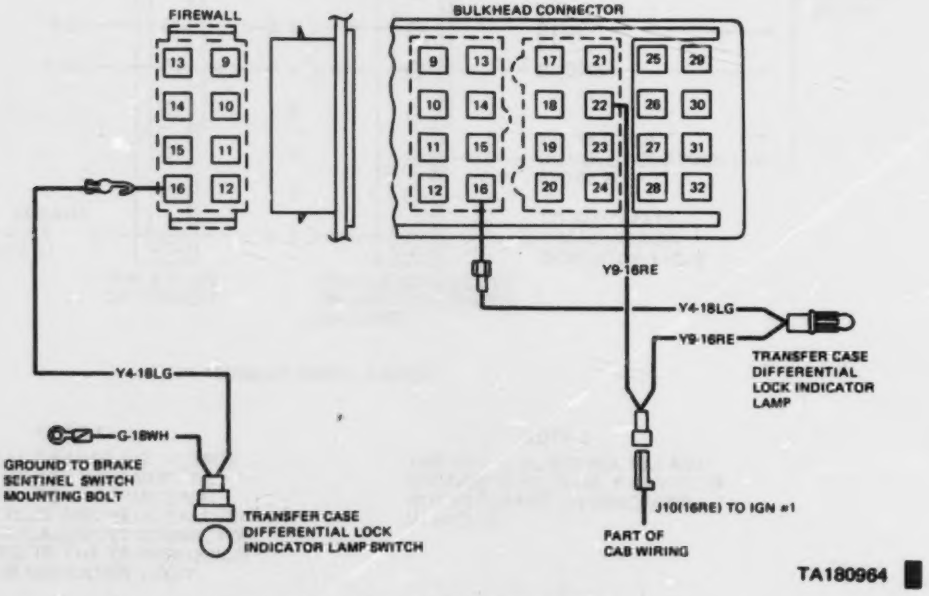

FIREWALL
13
9
14
10
15
11
16
12
BULKHEAD CONNECTOR
9
13
17
21
25
29
10
14
18
22
26
30
11
15
19
23
27
31
12
16
20
24
28
32
Y9-16RE
Y4-18LG
Y9-16RE
TRANSFER CASE DIFFERENTIAL LOCK INDICATOR LAMP
Y4-18LG
G-18WH
GROUND TO BRAKE SENTINEL SWITCH MOUNTING BOLT
TRANSFER CASE DIFFERENTIAL LOCK INDICATOR LAMP SWITCH
J10(16RE) TO IGN #1
PART OF CAB WIRING
TA180964

Figure 10-1.5 Transfer Case Differential Lock Indicator Lamp

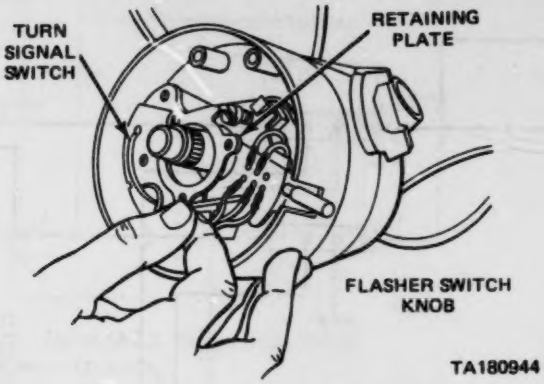
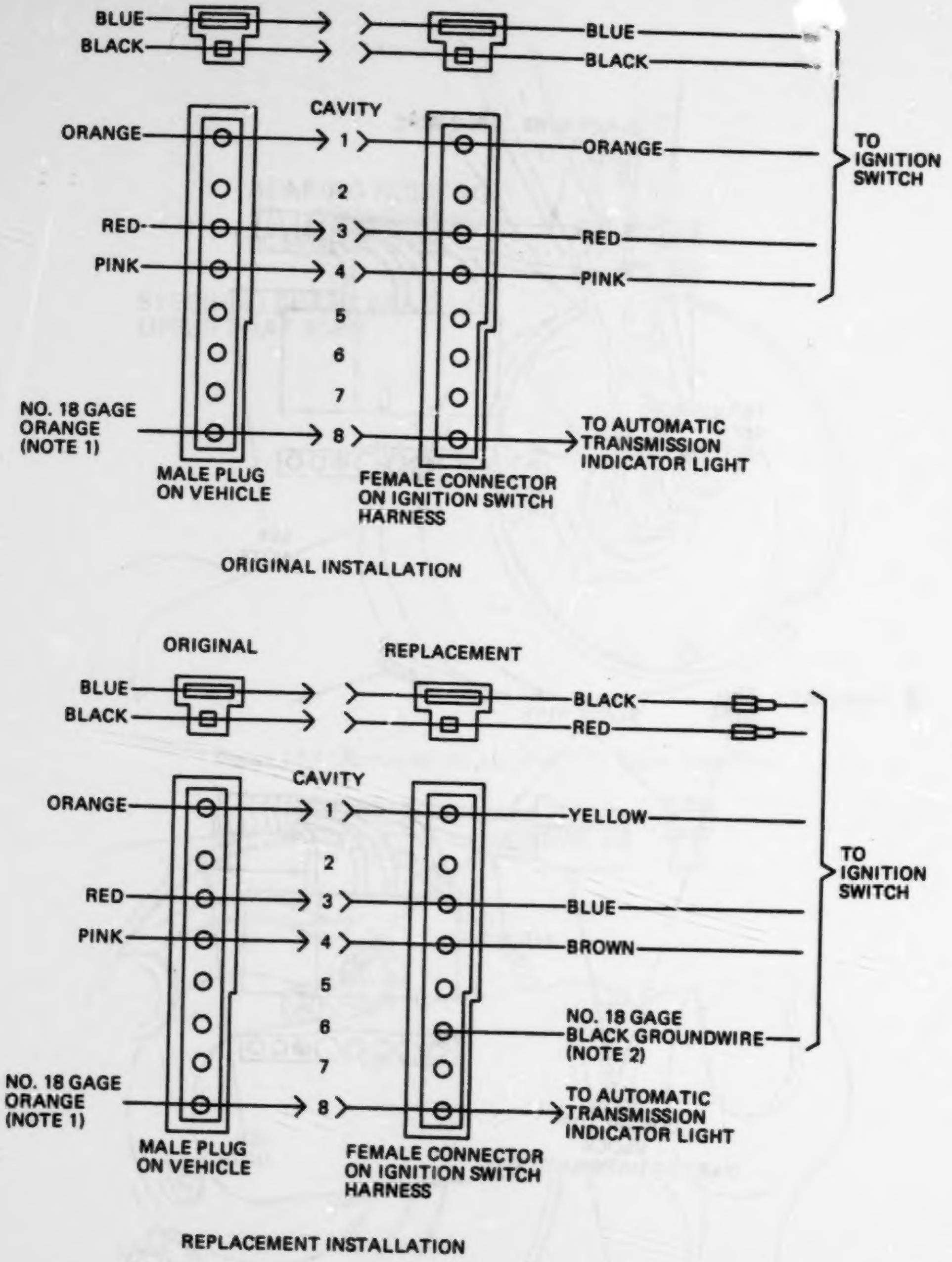

TURN SIGNAL SWITCH
RETAINING PLATE
FLASHER SWITCH KNOB
TA180944

Figure 10-2. Retainer and Turn Signal Switch.


BLUE
BLACK
BLUE
BLACK
CAVITY
ORANGE
1
ORANGE
TO IGNITION SWITCH
2
RED
3
RED
PINK
4
PINK
5
6
7
NO. 18 GAGE ORANGE (NOTE 1)
8
TO AUTOMATIC TRANSMISSION INDICATOR LIGHT
MALE PLUG ON VEHICLE
FEMALE CONNECTOR ON IGNITION SWITCH HARNESS
ORIGINAL INSTALLATION
ORIGINAL
REPLACEMENT
BLUE
BLACK
BLACK
RED
CAVITY
ORANGE
1
YELLOW
2
TO IGNITION SWITCH
RED
3
BLUE
PINK
4
BROWN
5
6
NO. 18 GAGE BLACK GROUNDWIRE (NOTE 2)
7
NO. 18 GAGE ORANGE (NOTE 1)
8
TO AUTOMATIC TRANSMISSION INDICATOR LIGHT
MALE PLUG ON VEHICLE
FEMALE CONNECTOR ON IGNITION SWITCH HARNESS
REPLACEMENT INSTALLATION

NOTE 1

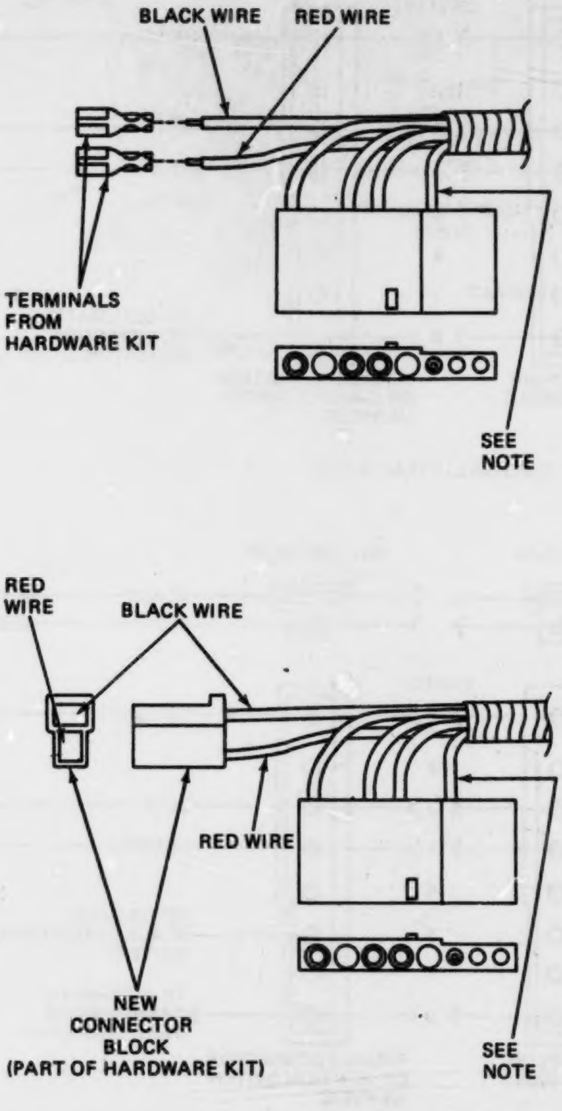
THE SMALL ORANGE NO. 18 GAGE WIRE IN CAVITY NO. 8 MUST BE REMOVED FROM THE ORIGINAL FEMALE PLUG AND REINSTALLED IN THE REPLACEMENT CONNECTOR, REROUTED TO THE TRANSMISSION SELECTOR INDICATOR LIGHT.

NOTE 2

THE SMALL BLACK NO. 18 GAGE GROUND WIRE IN NO. 6 CAVITY IS NOT REQUIRED ON M880/M890 VEHICLES.

TA180980

Figure 10-2.1 Ignition Switch Connector


BLACK WIRE
RED WIRE
TERMINALS FROM HARDWARE KIT
SEE NOTE
RED WIRE
BLACK WIRE
RED WIRE
NEW CONNECTOR BLOCK (PART OF HARDWARE KIT)
SEE NOTE

NOTE
THE SMALL BLACK NO. 18 GAGE GROUND WIRE IN NO. 6 CAVITY IS NOT REQUIRED ON M880/M890 VEHICLES

TA 180965

Figure 10-2.2 Replacement Ignition Switch Harness Installation

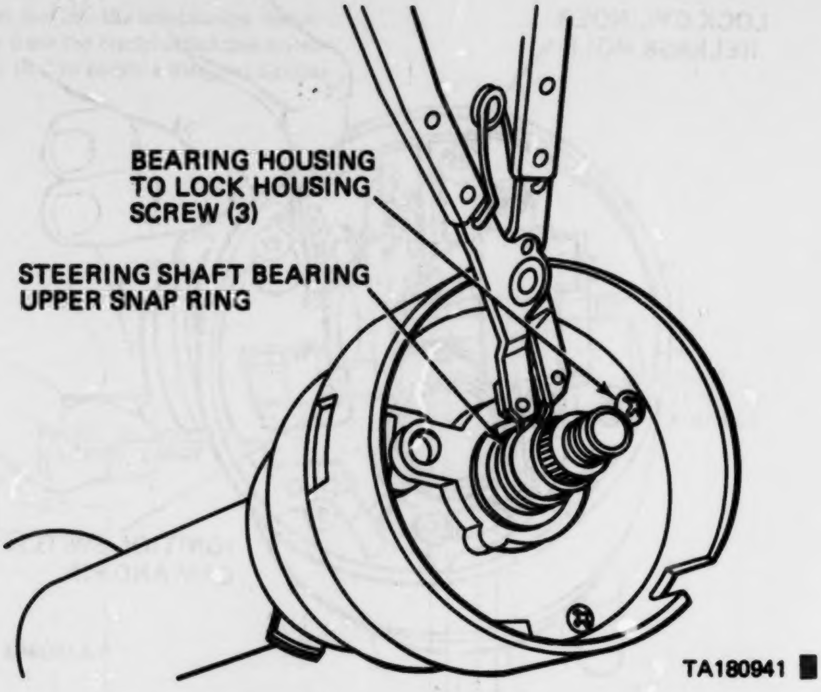

BEARING HOUSING
TO LOCK HOUSING
SCREW (3)
STEERING SHAFT BEARING
UPPER SNAP RING
TA180941

Figure 10-3. Removing the Steering Shaft Upper Snap Ring.

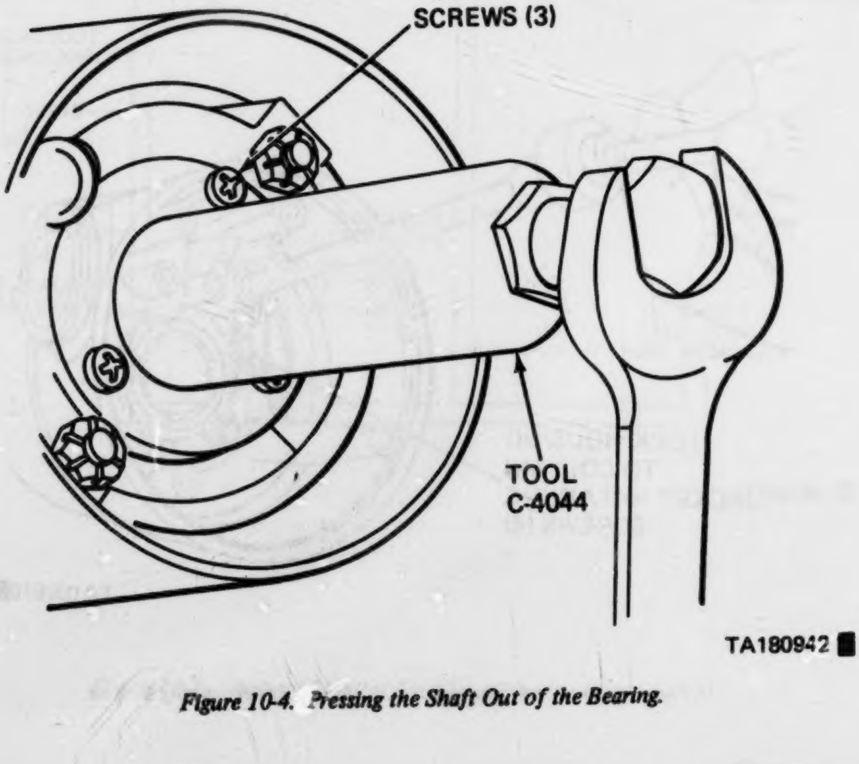

SCREWS (3)
TOOL
C-4044
TA180942

Figure 10-4. Pressing the Shaft Out of the Bearing.

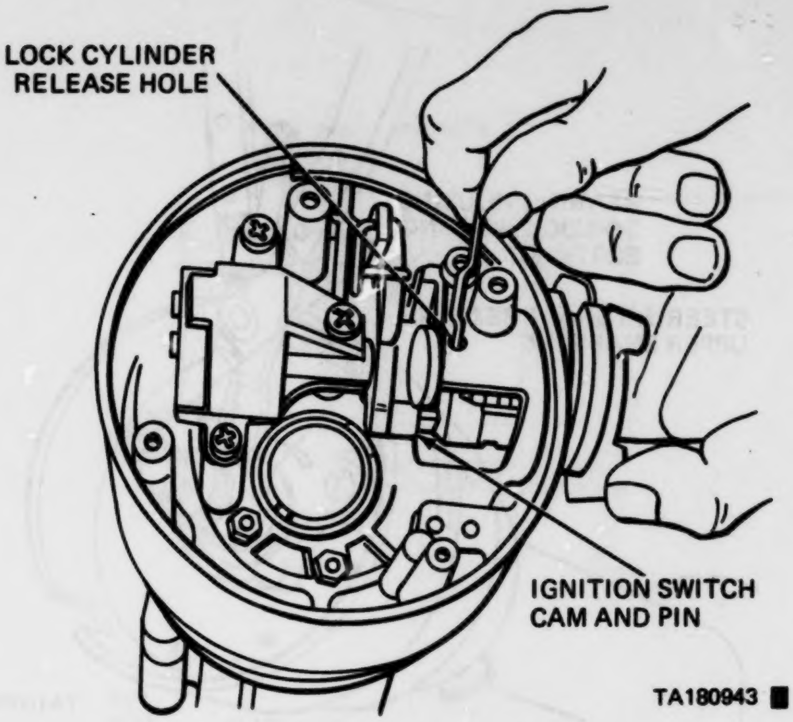

LOCK CYLINDER
RELEASE HOLE
IGNITION SWITCH
CAM AND PIN
TA180943

Figure 10-5. Removing the Lock Cylinder.

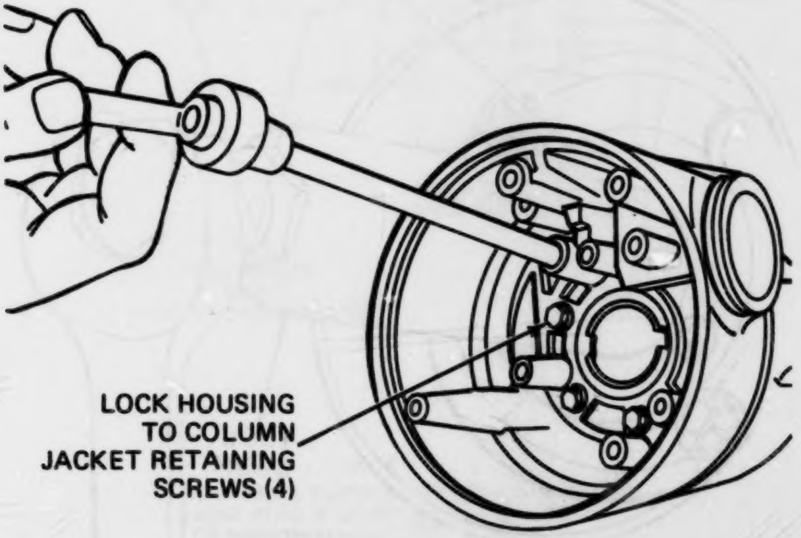

LOCK HOUSING
TO COLUMN
JACKET RETAINING
SCREWS (4)
TA180979

Figure 10-6. Lock Housing to Column Jacket Retaining Screws.

10-4. Blackout Lighting Repair.

The wiring diagram provides the information that is needed to electrically trace the blackout lighting system parts. Refer to figure 10-7 to isolate a blackout lighting problem.

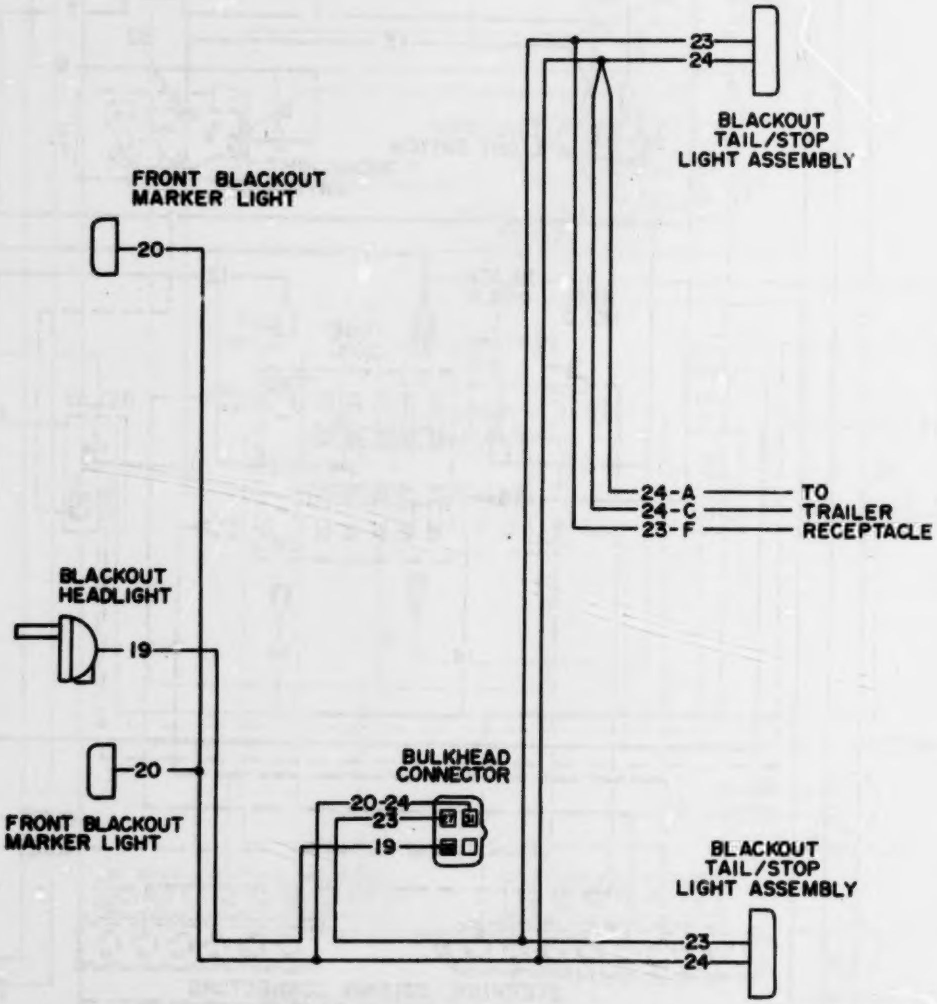

23
24
BLACKOUT TAIL/STOP LIGHT ASSEMBLY
FRONT BLACKOUT MARKER LIGHT
20
24-A
24-C
23-F
TO TRAILER RECEPTACLE
BLACKOUT HEADLIGHT
19
20
FRONT BLACKOUT MARKER LIGHT
BULKHEAD CONNECTOR
20-24
23
19
BLACKOUT TAIL/STOP LIGHT ASSEMBLY
23
24
TA106080

Figure 10-7. Blackout Lighting Kit Wiring Diagram (Sheet 1 of 3)

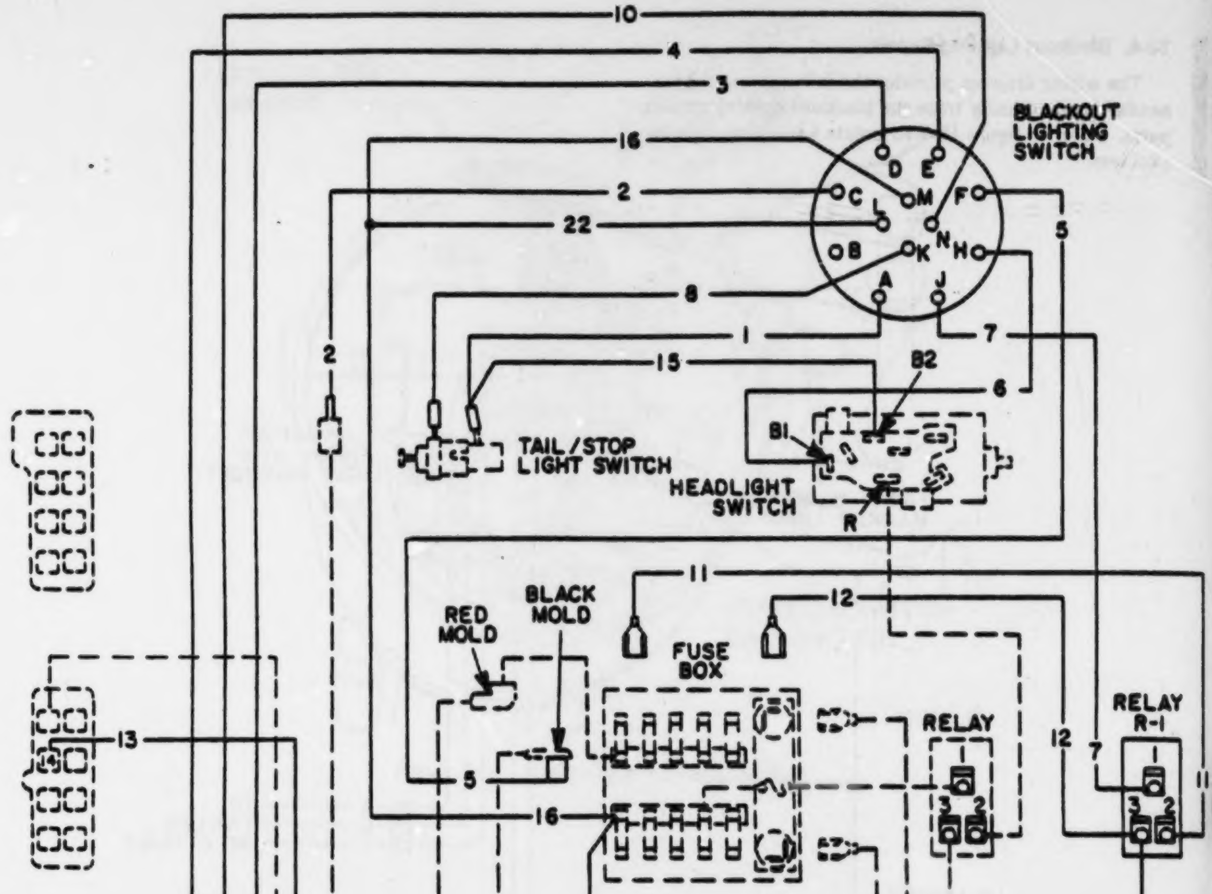

10
4
3
16
2
22
8
1
15
6
5
7
BLACKOUT
LIGHTING
SWITCH
D
E
C
L
M
F
N
B
K
H
A
J
2
TAIL/STOP
LIGHT SWITCH
B2
B1
HEADLIGHT
SWITCH
R
11
12
RED
MOLD
BLACK
MOLD
FUSE
BOX
RELAY
RELAY
R-1
13
5
16
12
7
1
3
2
3
2
11
13
14
14
AMMETER
STEERING COLUMN CONNECTORS
4
10
3
31
27
25
BULKHEAD
CONNECTORS
EXISTING VEHICLE WIRING
BLACKOUT KIT WIRING
IGNITION
SWITCH
TA234969

Figure 10-7. Blackout Lighting Kit Wiring Diagram (Sheet 2 of 3)

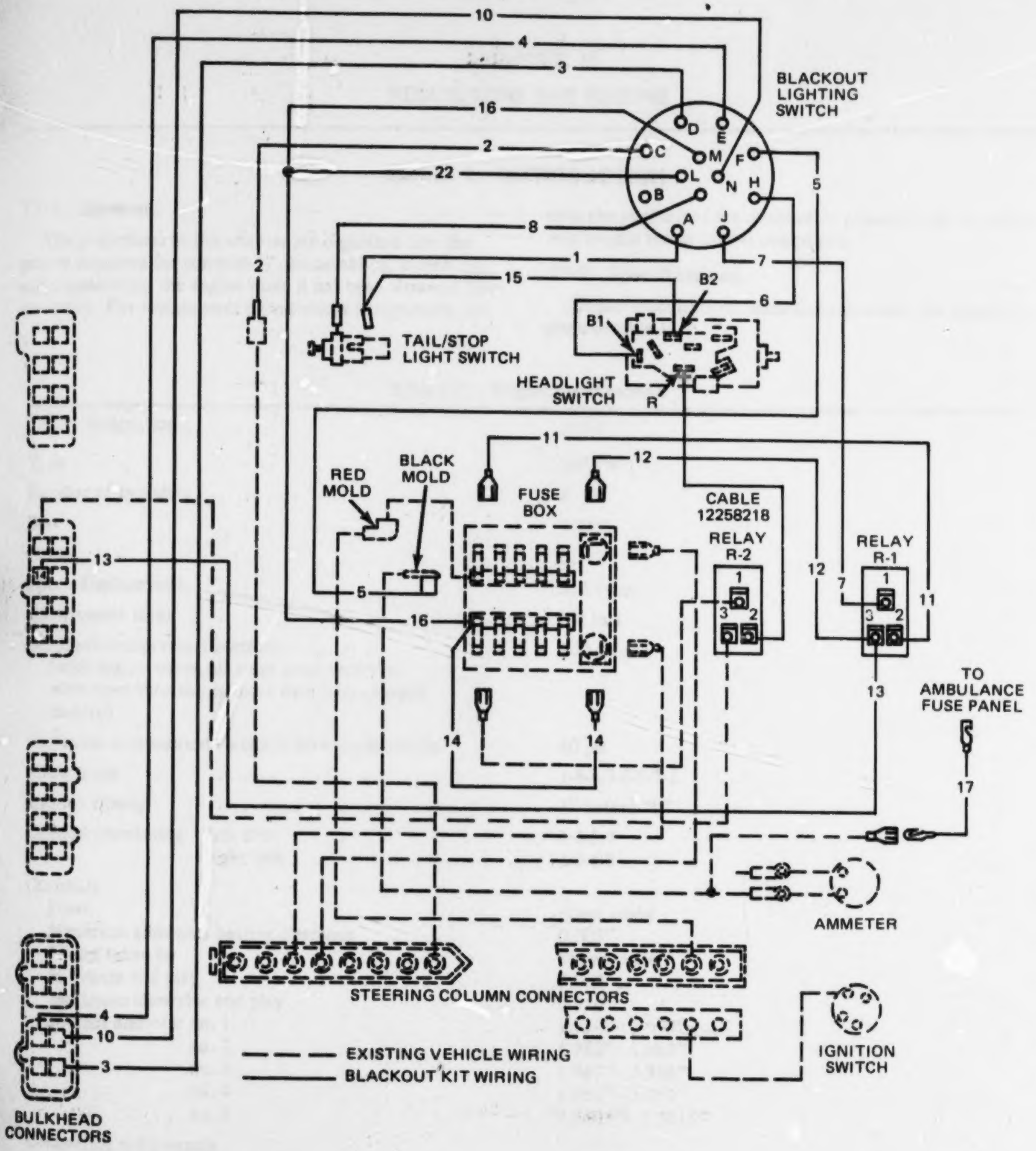

10
4
3
16
2
22
8
1
15
6
7
5
BLACKOUT LIGHTING SWITCH
D
E
C
M
F
L
N
H
B
A
J
B2
B1
TAIL/STOP LIGHT SWITCH
HEADLIGHT SWITCH
R
11
12
RED MOLD
BLACK MOLD
FUSE BOX
CABLE 12258218
RELAY R-2
RELAY R-1
1
2
3
13
14
TO AMBULANCE FUSE PANEL
17
AMMETER
STEERING COLUMN CONNECTORS
IGNITION SWITCH
EXISTING VEHICLE WIRING
BLACKOUT KIT WIRING
BULKHEAD CONNECTORS
TA234963

Figure 10-7. Blackout Lighting Kit Wiring Diagram-Ambulance (Sheet 3 of 3)

PART THREE
REPAIRS ON THE BENCH

CHAPTER 11
REBUILDING THE ENGINE

Section I. INTRODUCTION

11-1. General.

The procedures in this chapter are organized into the proper sequence for completely disassembling, inspecting, and reassembling the engine when it has been removed from the truck. For replacement of individual components, use only the portions of the disassembly sequence that are necessary to gain access to that component.

11-2. Specifications.

Engine specifications, including adjustment set-points, are given in table 11-1.

Table 11-1. Engine Specifications

Engine designation	318-1
Type	90° "V"
Number of cylinders	8
Bore	3.91"
Stroke	3.312"
Piston displacement	318 cu in
Compression ratio	8.6 to 1
Minimum compression pressure (with engine warm, all spark plugs removed, wide-open throttle, cranked with fully-charged battery)	100 psi
Maximum compression variation between cylinders	40 psi
Firing order	1-8-4-3-6-5-7-2
Ignition timing	2° before "0"
Cylinder numbering - left side	1-3-5-7
- right side	2-4-6-8
Camshaft	
Drive	Silent chain
Maximum allowable bearing clearance	0.005"
Thrust taken by	Thrust plate
Minimum end play	0.002"
Maximum allowable end play	0.010"
Journal diameter no. 1	1.998" - 1.999"
no. 2	1.982" - 1.983"
no. 3	1.967" - 1.968"
no. 4	1.951" - 1.952"
no. 5	1.5605" - 1.5615"
Connecting rod journals	
Diameter	2.124" - 2.125"
Minimum allowable out-of-round	0.001"
Maximum allowable taper	0.001"

Table 11-1. Engine Specifications—Continued

Connecting rod bearings	
Material	Aluminum
End play (two rods connected)	0.006" - 0.014"
Desired bearing clearance	0.0002" - 0.0022"
Maximum allowable bearing clearance	0.003"
Bearings available for service	Std., 0.010"
Crankshaft	
Type	Counter-balanced
Number of main bearings	5
Bearing material - no. 1, 2, & 4	Aluminum
- no. 5	Babbitt
- no. 3	Tin aluminum
Thrust taken by	No. 3
Main bearing clearance - desired	0.0005" - 0.0015"
- maximum allowable	0.0025"
End play	0.002" - 0.009"
Main bearing journal diameter	2.4995" - 2.5005"
Maximum allowable out-of round	0.001"
Maximum allowable taper	0.001"
Bearings available for service	Std., 0.010"
Cylinders - diameter of bore (nominal)	3.91"
Maximum allowable taper before reboring	0.010"
Maximum allowable out-of-round before reboring	0.005"
Maximum allowable taper after reboring	0.001"
Maximum allowable out-of-round after reboring	0.001"
Pistons	
Type	Aluminum
Material	Alloy tin-coated
Land clearance at top of skirt	0.0005" - 0.0015"
Weight (std. thru 0.040" oversize)	594.6 grams
Length (overall)	3.45"
Pistons available for service	Std., 0.005", oversize
Piston pins	
Type	Interference fit in rod
Diameter	0.9841" - 0.9843"
Length	2.990" - 3.000"
Clearance in piston (at 70° F)	0.00045" - 0.00075"
End play	0.004" - 0.026"
Interference in rod	0.0007" - 0.0014"
Pins available for service	Standard only
Piston rings	
Compression rings - number used	2
Oil rings - number used	1
Oil ring type	3-piece steel rail - chrome face
Compression ring gap	0.010" - 0.020"
Oil ring gap - steel rails	0.015" - 0.055"
Compression ring side clearance in groove	0.0015" - 0.0030"
Oil ring/steel rail side clearance in groove	0.0005" - 0.0050"
Intake valves	
Type	Solid stem
Head diameter	1.775" - 1.785"
Overall length	4.962" - 4.987"
Stem diameter	0.372" - 0.373"
Stem-to-guide clearance - maximum allowable - (measured with tools C-3973 and dial indicator using wobble method)	0.017"

Table 11-1. Engine Specifications–Continued

Face angle	45°
Valve lift (zero lash)	0.373"
Valve seat inserts	None
Exhaust valves	
Type	Solid stem
Head diameter	1.495" - 1.505"
Overall length	4.985" - 5.020"
Stem diameter	0.371" - 0.372"
Stem-to-guide clearance (wobble method)	0.017"
Face angle	43° - 45°
Valve lift (zero lash)	0.400"
Seat inserts	None
Cylinder head	
Valve seat runout (maximum)	0.002"
Valve seat angle - intake & exhaust	45°
Valve seat width (finished) - intake	0.065" - 0.085"
- exhaust	0.040" - 0.060"
Valve guides - type	Cast-in-head
Guide bore diameter	0.374" - 0.375"
Valve springs	
Free length - intake	2.00"
- exhaust	1-13/16"
Load when compressed (lbs @ in)	
Intake - valve closed	78 - 88 @ 1-11/16"
- valve open	170 - 184 @ 1-5/16"
Exhaust - valve closed	80 - 90 @ 1-31/64"
- valve open	180 - 194 @ 1-5/16"
Spring inside diameter	1.010" - 1.030"
Maximum allowable out of square	1/16"
Installed height - seat to retainer	
Intake (seat to retainer)	1-5/8" - 1-11/16"
Exhaust (seat to rotator)	1-29/64" - 1-33/64"
Tappets - type	Hydraulic
Body diameter	0.9035" - 0.9040"
Clearance in block	0.00175"
Tappets available for service	Std., 0.001", 0.008", and 0.030" oversizes
Dry lash	0.060" - 0.210"
Valve timing	
Intake opens (BTC)	10°
Intake closes (ATC)	230°
Exhaust opens (ATC)	128°
Exhaust closes (ATC)	16°
Valve overlap	26°
Intake valve duration	240°
Exhaust valve duration	248°
Engine lubrication - type	Full pressure
Oil pump - type	Rotary
Location	In sump
Drive	Camshaft gear
Minimum pump pressure at idle	8 lbs
Operating pressure	
At 2000 engine rpm	30-80 lbs
Oil filter type	Spin-on throwaway
Oil capacity (less filter) qts	5
(with filter) qts	6

Section II. DISASSEMBLY AND CLEANING

11-3. Engine Disassembly.

a. Preparation. Remove the engine from the truck and install it in a test stand (paragraph 3-13).

b. Disassembly. When the engine is being disassembled for a complete overhaul, remove components in the following sequence:

(1) Engine lifting eye (from the intake manifold).

(2) Fan belt, fan, spacer, and pulley (if not already removed).

(3) Alternator and alternator bracket.

(4) Thermostat housing, thermostat, and bypass hose.

(5) Temperature and oil pressure gage sending units.

(6) Ignition coil.

(7) Choke element (from the intake manifold).

(8) Distributor assembly, including wires.

(9) Spark plugs.

(10) Oil filter.

(11) Fuel pump.

(12) Water pump.

(13) Exhaust manifolds.

(14) Valve covers, crankcase breather, and PCV valve.

(15) Rocker arm shaft assemblies.

(16) Push rods. Identify them so that each one can be installed in its original position.

(17) Intake manifold.

(18) Valve tappets.

(19) Cylinder heads.

(20) Use a cylinder ridge reamer to remove the ridges at the top of the cylinder bores.

(21) Oil pan.

(22) Oil pickup screen and oil pump (with drive shaft).

NOTE

Before proceeding to step 23, inspect the connecting rods and rod caps for cylinder identification. Identify them, if necessary, so they can be reinstalled in their original position.

(23) Connecting rod caps. When removing the piston and connecting rod assemblies from the engine, rotate the crankshaft so that each connecting rod is centered in the cylinder bore as you lift it out. Use a hammer handle to push each piston and rod assembly out of the cylinder bore. Be careful not to damage the crankshaft journals.

(24) Vibration dampener (harmonic balancer). See figure 11-2.

Figure 11-1. Deleted.

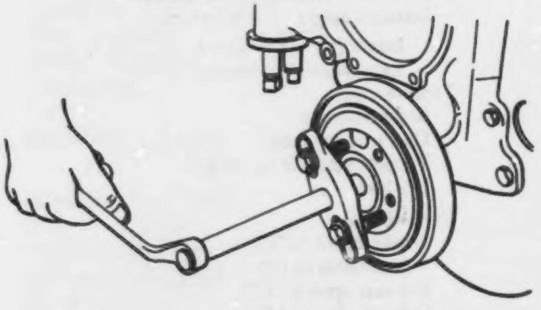


Figure 11-2. Removing Vibration Damper Assembly.

(25) Timing chain cover.

(26) Timing chain, sprocket, and fuel pump eccentric.

(27) Main bearing caps. Identify each cap for correct location and position.

(28) Crankshaft.

(29) Camshaft thrust plate. Note the location of the timing chain oil tab (figure 11-3).

(30) Install a long bolt into the front of the camshaft for easy removal. Remove the camshaft, being careful not to scar the bearings.

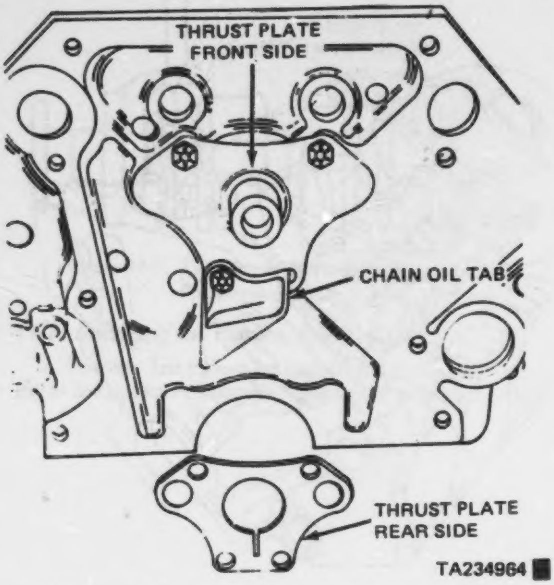


Figure 11-3. Timing Chain Oil Tab Location.

11-4. Cleaning.

a. Check all core hole plugs for leakage; mark any leaky plugs for replacement.

b. Clean all parts, using the appropriate method. When solvent or carbon removal compound is used for cleaning, blow the parts dry with compressed air. Be careful not to nick or scar any machined surfaces.

c. Lubricate all machined surfaces following cleaning.

Section III. INSPECTION AND MEASUREMENT

11-5. Servicing the Cylinder Block.

a. General. Some engines will have cylinder bores machined to 0.020 inch oversize at the factory. These engines are identified with the letter "A" stamped on the engine serial pad. See table 11-1 for information on oversized and undersized parts.

b. Inspection.

(1) Use compressed air to clean oil and coolant passages.

(2) Examine the block for cracks or fractures; discard the block if you find any.

(3) Inspect all threaded holes for damage; repair as necessary, in accordance with paragraph 11-12. Replace damaged bolts, screws, and nuts.

(4) Replace any leaky core hole plugs. Coat the edges of the new plug and core hole with sealer. Drive the core plug in so that the rim is indented 1/64 inch.

(5) Inspect the distributor drive shaft bushing for damage. Replace if necessary (paragraph 11-13).

c. Measurements.

(1) Use a straightedge to check the cylinder block head gasket surface for flatness (figure 11-4). If warpage exceeds 0.009 inch per foot, resurface or replace the block.

(2) Measure the cylinder walls for out-of-roundness, or a taper of more than 0.010 inch, or if the cylinder walls are badly scuffed or scored, rebore and hone the cylinder block and fit new pistons and rings. Before boring, refer to table 11-1 to determine what size bore and replacement piston to use. See figure 11-5.

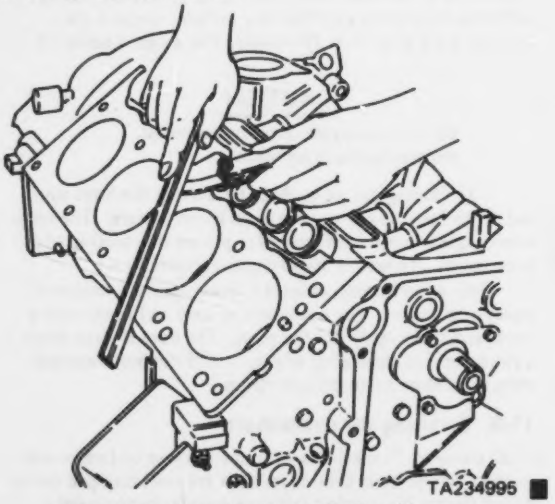


Figure 11-4. Measuring Gasket Surface Warpage.

d. Honing Cylinder Bores.

(1) Use a cylinder hone for this job. In addition to deglazing, it reduces taper and out-of-roundness and removes light scuffing, scoring, or scratches. Usually a few strokes will clean up a bore and maintain the required limits.

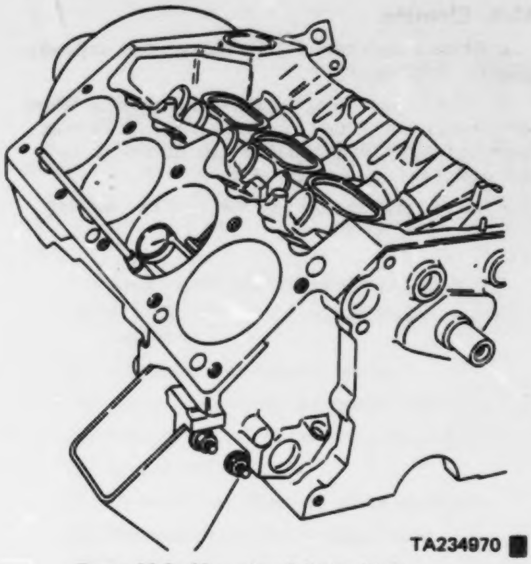


Figure 11-5. Measuring Cylinder Walls.

(2) The cylinder walls may be deglazed using a cylinder surfacing hone (figure 11-5.1). Use a hone equipped with 280-grit stones if the cylinder bore is straight and round. Depending on the bore condition, 20 to 60 strokes will be sufficient to provide a satisfactory surface. Inspect the cylinder walls after each 20 strokes. Use a light honing oil.

CAUTION

Do not use engine or transmission oil, mineral spirits, or kerosene.

(3) Honing should be done by moving the hone up and down fast enough to get a cross hatch pattern. The cross hatch angle is most satisfactory for proper ring seating when hone marks intersect at 50-60 degrees (figure 11-6).

(4) After honing, clean the block again to remove all traces of abrasives. Use a solution of soap and water with a brush and thoroughly dry the parts. The bore is clean when a cloth remains clean after wiping it. Oil the bores immediately after cleaning to prevent rusting.

11-6. Servicing the Crankshaft.

a. General. Crankshafts with one or more undersize connecting rods or main bearing journals are steel stamped on the milled flat on the number eight crankshaft counterweight (figure 11-7 and table 11-2). A crankshaft with 0.010 inch undersize journals has all rod journals, all main journals, or both, undersize. When replacing a crankshaft, replace all main and connecting rod bearings with the correct size new bearings; selective fitting is not required.

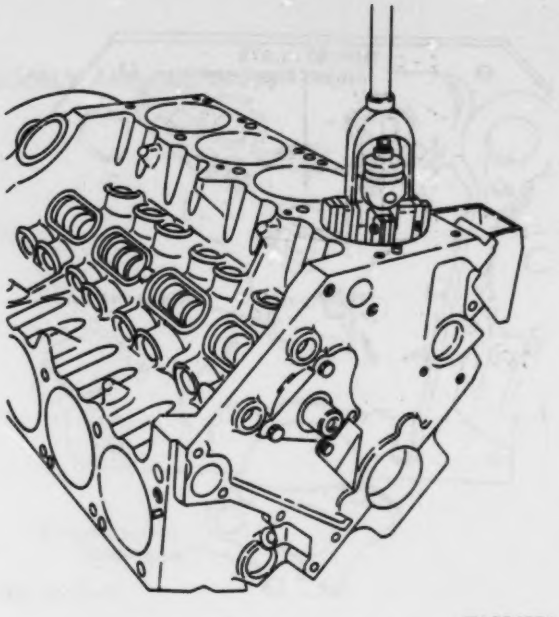


Figure 11-5.1. Deglazing Cylinders.

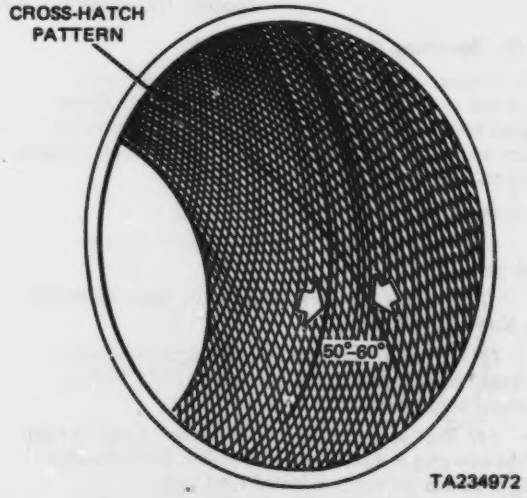


Figure 11-6. Cross Hatch Pattern.

b. Measurements. Measure the crankshaft journals for taper and out-of-roundness. Maximum allowable out-of-round and maximum allowable taper are both 0.001 inch. Replace crankshafts that do not meet specifications.

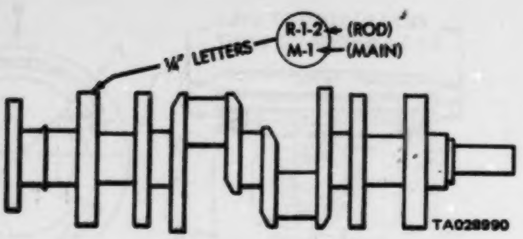


Figure 11-7. Location of Internal Marking of No. 8 Counterweight.

11-7. Servicing the Pistons, Pins, and Rings.

a. General. The pistons are cam-ground so that the diameter at the pin boss is less than the diameter across the thrust face. This allows for expansion under normal operating conditions. Under operating temperatures, expansion forces the pin bosses away from each other, thus causing the piston to assume a nearly round shape. It is important that pistons be checked for taper and elliptical shape before they are fitted into the cylinder bore (figure 11-8).

Table 11-2. Identification Stamp for Undersize Journals

Identification stamp	Undersize journal
R1, R2, R3, or R4	0.001 in
RX	0.010 in
M1, M2, M3, M4, or M5	0.001 in
MX	0.010 in

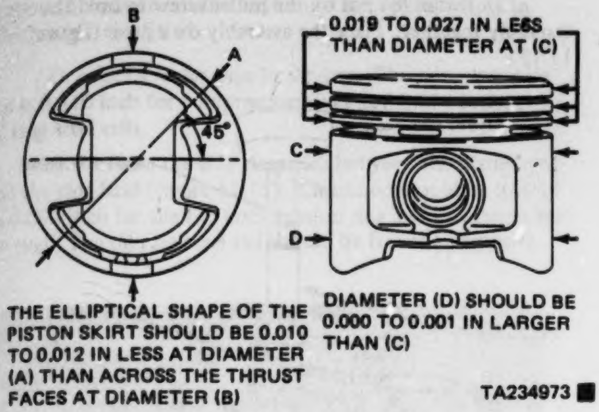

B
A
45°
0.019 TO 0.027 IN LESS THAN DIAMETER AT (C)
C
D
THE ELLIPTICAL SHAPE OF THE PISTON SKIRT SHOULD BE 0.010 TO 0.012 IN LESS AT DIAMETER (A) THAN ACROSS THE THRUST FACES AT DIAMETER (B)
DIAMETER (D) SHOULD BE 0.000 TO 0.001 IN LARGER THAN (C)
TA234973

Figure 11-8. Piston Measurements.

b. Finished Pistons. All pistons are machined to the same weight in grams, regardless of oversize, to maintain piston balance. Pistons with pins are available in standard size only.

NOTE

Pay special attention to oversize bores when overhauling the engine. Specifications for these parts are in table 11-1.

c. Disassembly.

(1) Install the bearing cap on the mating rod.

(2) Remove the rings.

(3) Arrange tool C-4158-L for removal of the piston pin (figure 11-9).

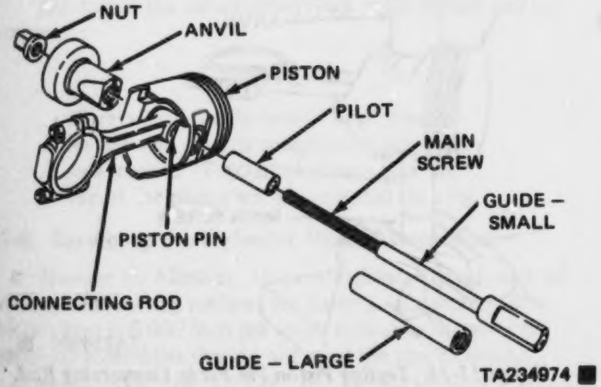

NUT
ANVIL
PISTON
PILOT
MAIN SCREW
GUIDE – SMALL
PISTON PIN
CONNECTING ROD
GUIDE – LARGE
TA234974

Figure 11-9. Arrangement of Tool C-4158-L for Removing Piston Pin.

(4) Install the pilot on the main screw.

(5) Install the main screw through the piston pin.

(6) Install the anvil over the threaded end of the main screw, with the small end of the anvil against the piston boss. Be sure the spring is removed from the anvil.

(7) Install the nut loosely on the main screw and place the assembly on a press (figure 11-10).

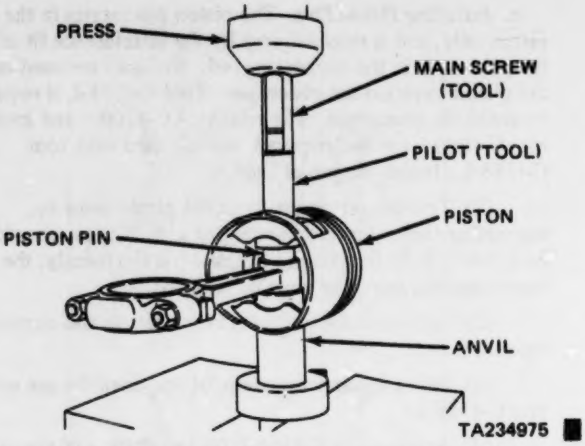

PRESS
MAIN SCREW (TOOL)
PILOT (TOOL)
PISTON
PISTON PIN
ANVIL
TA234975

Figure 11-10. Removing Piston Pin with Tool C-4158-L.

(8) Press the piston pin out of the connecting rod.

CAUTION

When the pin falls free from the connecting rod, stop the press to prevent damage to the bottom of the anvil.

(9) Remove the tool from the piston.

d. Fitting Pistons. The piston and cylinder wall must be clean and dry. Specified clearances between the piston and the cylinder wall are 0.0005 to 0.0015 inch. Measure the piston clearance at the top of the skirt at a 90 degree angle to the piston pin axis (figure 11-11).

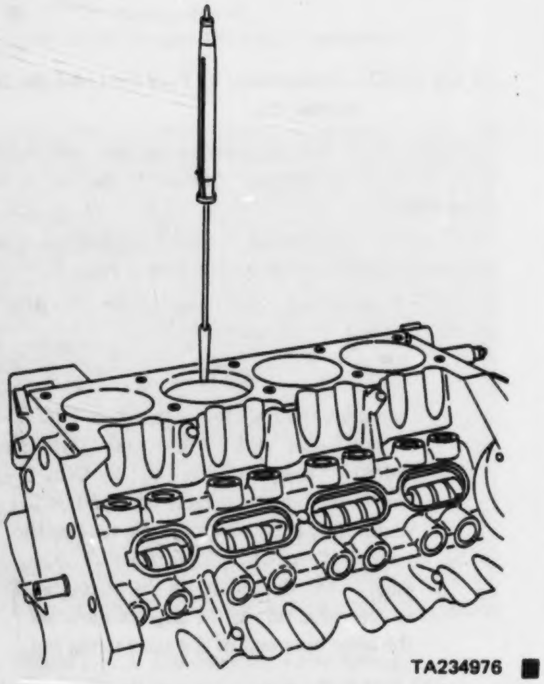


Figure 11-11. Measuring Piston Diameter.

e. Installing Piston Pins. The piston pin rotates in the piston only, and is retained only by the interference fit of the piston pin in the connecting rod. No locks are used in the piston to retain the piston pin. Tool C-4158-L is required to install the piston pin. The pilot tool C-4200-3 and anvil tool C-4200-1 are also required, and are used with tool C-4158-L. Install the pin as follows:

(1) Test the piston pin fit in the piston prior to assembling the piston and connecting rod. The pin should be a sliding fit in the piston. If a new pin fits loosely, the piston and pin assembly must be replaced.

(2) Lubricate the pin holes in the piston and connecting rod.

(3) Select the appropriate pilot and anvil for use with tool C-4158-L.

(4) Arrange tool C-4158-L for installation of the piston pin (figure 11-12).

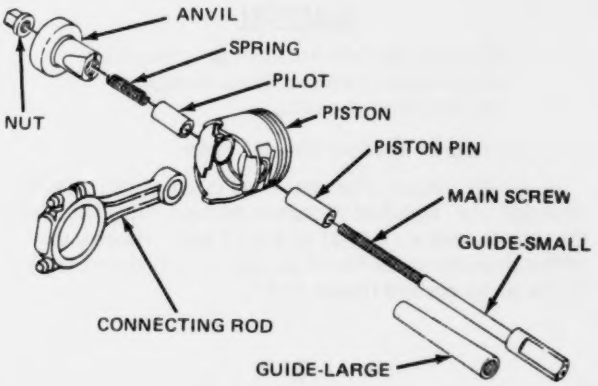


Figure 11-12. Arrangement of Tool C-4158-L for Installing Piston Pin.

(5) Install the spring inside the pilot and install the spring and pilot in the anvil. Install the piston pin over the main screw.

(6) Place the piston, with the front up, over the pilot so the pilot extends through the piston pin hole.

(7) Position the connecting rod over the pilot which extends through the piston pin hole.

NOTE

Assemble the rods to the pistons of the right cylinder bank (2, 4, 6, and 8) with the indent on the piston head opposite the large chamfer on the large bore end of the connecting rod. Assemble the rods to the pistons of the left cylinder bank (1, 3, 5, and 7) with the indent on the piston head on the same side as the large chamfer on the large bore end of the connecting rod.

(8) Install the main screw and the piston pin in the piston.

(9) Install the nut on the puller screw to hold the assembly together. Place the assembly on a press (figure 11-13).

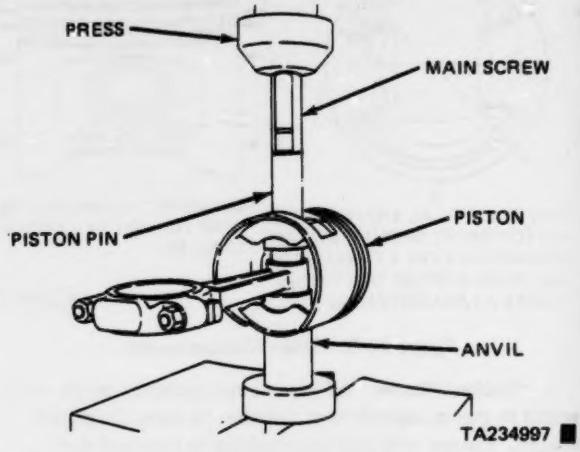


Figure 11-13. Installing Piston Pin with Tool C-4158-L.

(10) Press the piston pin in until the pin bottoms on the pilot. This will position the pin in the connecting rod.

(11) To measure pin fit, remove the tool and arrange tool parts and the piston assembly as shown in figure 11-14.

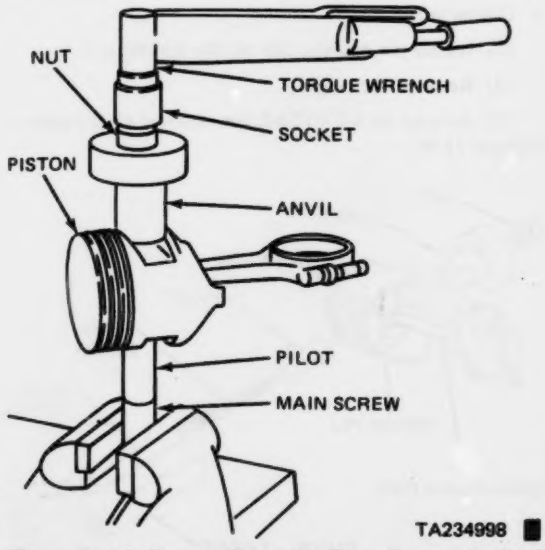


Figure 11-14. Testing Piston Pin Fit in Connecting Rod.

(12) Attach a torque wrench to the nut and tighten to 15 ft-lbs. The connecting rod should not move. If it moves, obtain a connecting rod with the proper small end bore diameter and repeat the installation and tightening procedure.

f. Fitting Rings.

(1) Use an inverted piston to push the rings down to insure positioning the rings squarely in the cylinder bore before measuring. Measure the piston ring gap when the ring

is about 2 inches from the bottom of the cylinder bore in which it is to be fitted.

(2) Insert a feeler gage in the gap. The minimum ring gap is 0.010 inch for compression rings and 0.015 inch for oil ring steel rails.

(3) Measure the side clearance between the piston ring and the ring land (figure 11-15). Clearance should be 0.0015 to 0.003 inch for the top compression ring and the intermediate ring. The oil ring steel rail should be free in the groove.

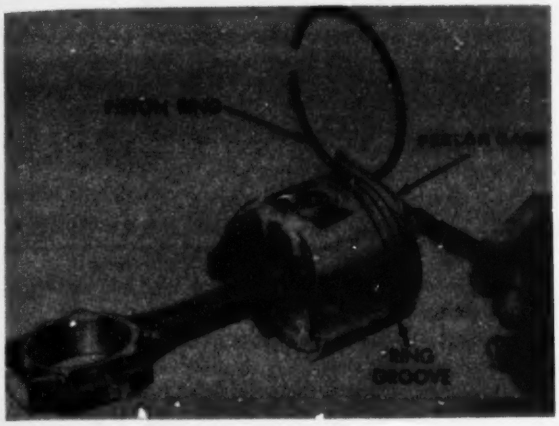

PISTON RING
FEELER GAGE
RING GROOVE

Figure 11-15. Measuring Piston Ring Side Clearance.

(4) Insert the keys on the spacer expander into the hole in the oil ring groove (over the piston pin front boss). Install the ring as shown in figure 11-16.

(5) Install the compression rings in the middle and top grooves.

NOTE

> Always look for the word "Top" marked on one side of each compression ring. The side marked "Top" must always face the top of the piston when you install the ring.

11-8. Servicing the Cylinder Head Assemblies.

a. Measure for Flatness. Use a straightedge to measure the cylinder head mating surfaces for flatness. Maximum allowable warpage is 0.009 inch per foot. Reface or replace cylinder head assemblies that do not meet the specification.

b. Disassembly. Disassemble the cylinder heads as follows:

(1) Compress the valve springs using a valve spring compressor (figure 11-17).

(2) Remove the valve retaining locks, spring retainers, step cup, seals, and springs.

(3) Before removing the valves, remove any burrs from the valve stem lock grooves to prevent damage to the valve guide.

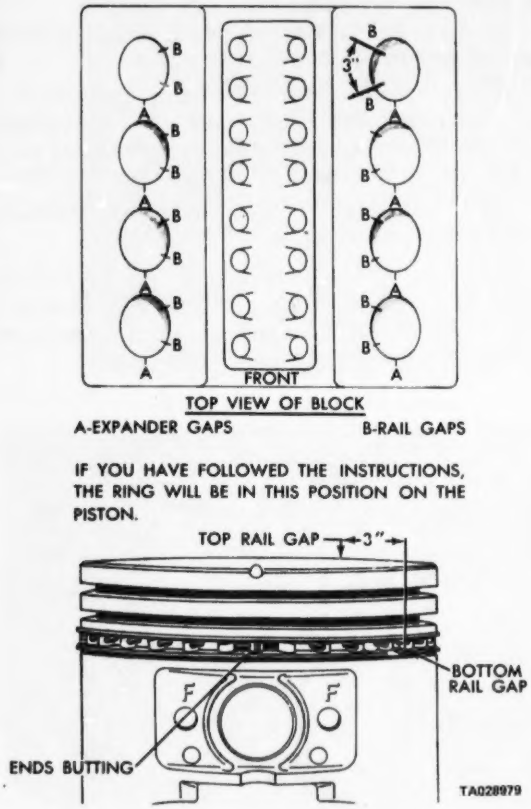

B
B
A
B
B
A
B
B
A
B
B
A
B
3"
B
A
B
B
A
B
B
A
B
B
A
FRONT
TOP VIEW OF BLOCK
A-EXPANDER GAPS
B-RAIL GAPS
IF YOU HAVE FOLLOWED THE INSTRUCTIONS, THE RING WILL BE IN THIS POSITION ON THE PISTON.
TOP RAIL GAP
3"
BOTTOM RAIL GAP
F
F
ENDS BUTTING
TA028979

Figure 11-16. Proper Oil Ring Installation.

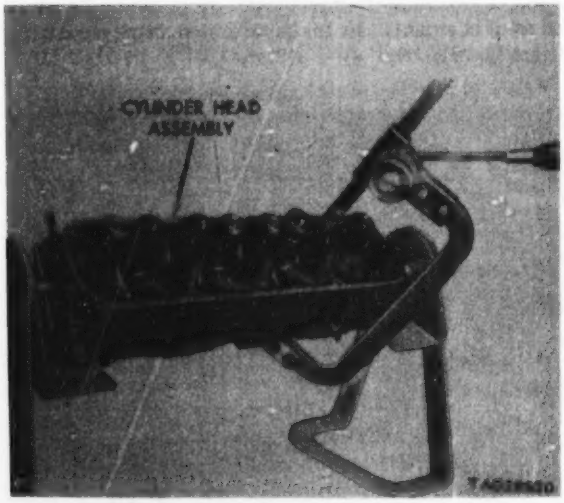

CYLINDER HEAD ASSEMBLY

Figure 11-17. Compressing Valve Spring.

(4) Remove the valves; tag them to insure installation in their original location.

c. Inspecting the Valves.

(1) Clean the valves thoroughly and discard any burned, warped, or cracked valves.

(2) Measure the valve stems for wear. A new intake valve stem diameter should measure 0.372 to 0.373 inch and the exhaust valve stem diameter should measure 0.371 to 0.372 inch. If wear exceeds 0.002 inch, replace the valve.

(3) Remove carbon and varnish deposits from the inside of the valve guides.

(4) Measure the valve stem guide clearance as follows:

(a) Install sleeve tool C-3973 over the valve stem (figure 11-18) and install the valve. The special sleeve places the valve at the correct height for a dial indicator.

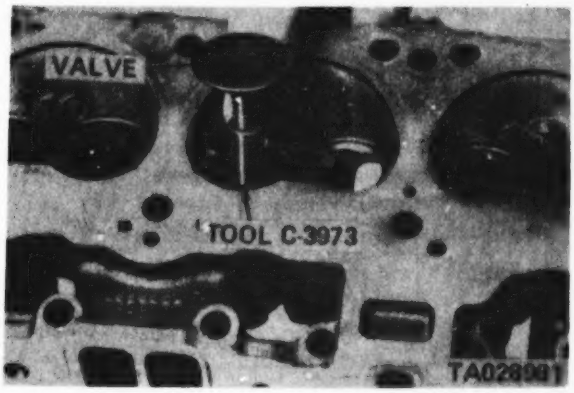


Figure 11-18. Installing Valve and Tool C-3973.

(b) Attach a dial indicator to the cylinder head and set it at a right angle to the valve stem being measured (figure 11-19).

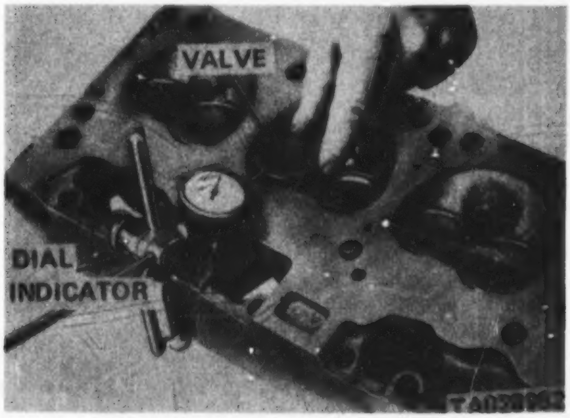


Figure 11-19. Measuring Valve Guide Wear.

(c) Move the valve to and from the indicator. The dial indicator reading should not exceed 0.017 inch. Ream the guides for valves with oversize stems if the dial indicator reading is excessive.

NOTE

Service valves with oversize stems are available in 0.005, 0.015, and 0.030 inch oversize. Reamer sizes to accommodate the oversize valve stem are set forth in table 11-3.

Table 11-3. Reamer Sizes

Reamer oversize	Valve guide size
0.005 in	0.379 - 0.380 in
0.015 in	0.389 - 0.390 in
0.030 in	0.404 - 0.405 in

(d) Slowly turn the reamer by hand and clean the guide thoroughly before installing a new valve.

NOTE

Do not attempt to ream the valve guides from standard directly to 0.030 inch. If it is necessary to go to 0.030 inch, use a step procedure of 0.005, 0.015, and 0.030 inch so the valve guides may be reamed true in relation to the valve seat.

d. Refacing Valves and Valve Seats.

(1) The intake and exhaust valve faces and seats have a 45 degree angle. These angles are shown in figure 11-20.

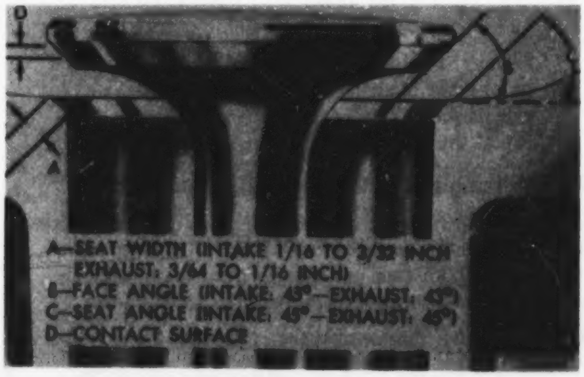

D
A
A—SEAT WIDTH (INTAKE 1/16 TO 3/32 INCH EXHAUST: 3/64 TO 1/16 INCH)
B—FACE ANGLE (INTAKE: 45°—EXHAUST: 45°)
C—SEAT ANGLE (INTAKE: 45°—EXHAUST: 45°)
D—CONTACT SURFACE

Figure 11-20. Valve Face and Seat Angle.

(2) Inspect the remaining margin after the valves are refaced (figure 11-21). Discard any valves with less than 3/64-inch margin.

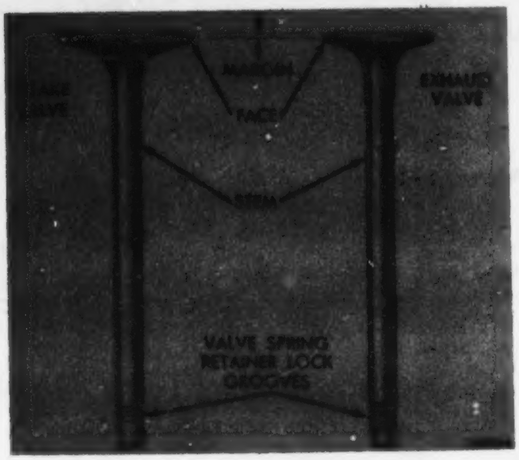


Figure 11-21. Intake and Exhaust Valves.

(3) When refacing the valve seats, it is important to use the correct size valve guide pilot for reseating stones. A true and complete surface must be obtained.

(4) Measure the runout of the valve seat using a dial indicator. Total runout should not exceed 0.002 inch.

(5) Check the valve seat with Prussian blue to determine where the valve contacts the seat. To do this, coat the valve seat lightly with Prussian blue then set it in place. Rotate the valve with light pressure. If the blue is transferred to the center of the valve face, contact is satisfactory. If the blue is transferred to the top edge of the valve face, lower the valve seat with a 30-degree stone. If the blue is transferred to the bottom edge of the valve face, raise the valve seat with a 60-degree stone.

(6) When the seat is properly positioned, the width of intake seats should be 1/16 to 3/32 inch. The width of the exhaust seats should be 3/64 to 1/16 inch.

e. Testing Valve Springs. Test the valve springs whenever the valves have been removed for inspection, reconditioning, or replacement.

(1) Intake valve springs. Turn the table of the valve spring compression tester (figure 11-22) until the surface is in line with the 1-1/4 inch mark on the threaded stud, with the zero mark to the front. Place the spring over the stud on the table, and lift the compressing lever to set the tester's tone device. Then pull on the torque wrench until you hear the tone device ping. The reading on the torque wrench at this instant should be 88 to 96 ft-lbs (equivalent to 177 to 192 pounds of pressure).

(2) Exhaust valve springs. Use the compression testing procedure for intake valve springs, but set the table to the 1-5/16 inch mark. When the tester's tone device pings, the torque wrench reading should be 90 to 97 ft-lbs (equivalent to 180 to 194 pounds of pressure).

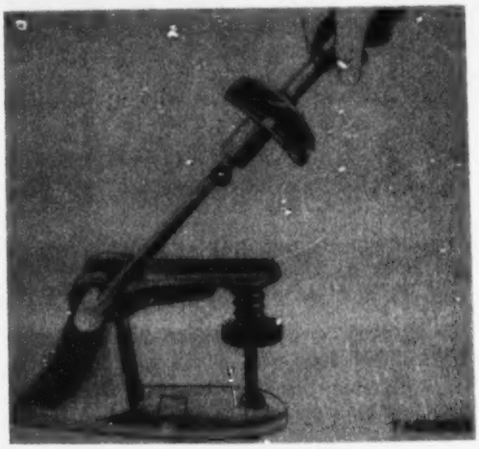


Figure 11-22. Testing Valve Springs.

(3) Inspect for squareness. Check each valve spring for squareness with a steel square and a surface plate (figure 11-23). Replace springs that are more than 1/16 inch out-of-square.

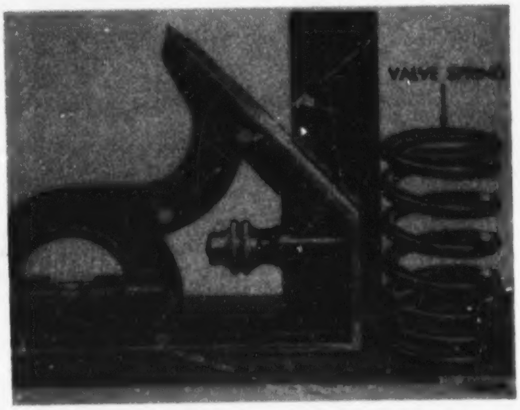


Figure 11-23. Inspecting Valve Spring Squareness.

f. Installing Valve Springs. See figure 11-24 for a disassembled view of the valve assemblies.

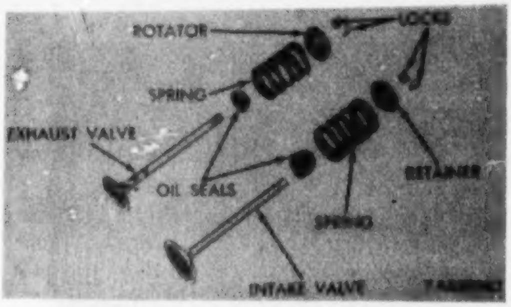

ROTATOR
LOCKS
SPRING
EXHAUST VALVE
OIL SEALS
RETAINER
SPRING
INTAKE VALVE

Figure 11-24. Valve Assemblies.

(1) Coat the valve stems with lubrication oil and insert them in the cylinder head.

(2) If the valves or seats have been reground, use tool C-3968 to check the valve stem height (figure 11-25). If the valve is too long, grind off the tip until the length is within limits.

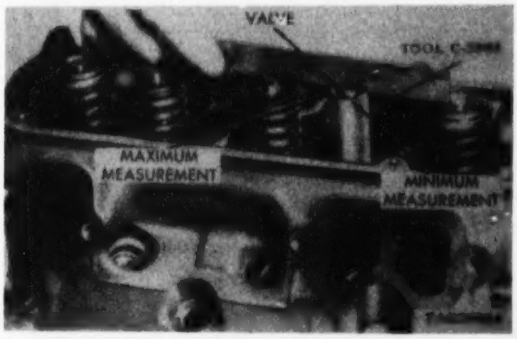

VALVE
TOOL C-3968
MAXIMUM MEASUREMENT
MINIMUM MEASUREMENT

Figure 11-25. Measuring Valve Stem Length.

(3) Install new cup seals on all valve stems and over the valve guides (figure 11-26). Install valve springs and retainers.

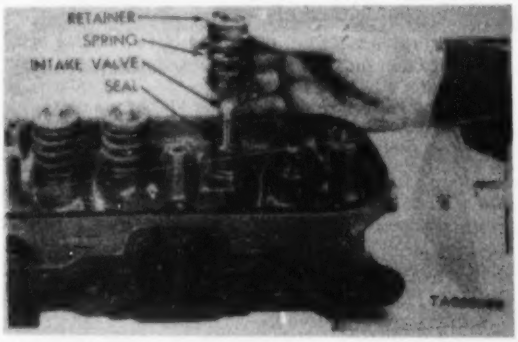

RETAINER
SPRING
INTAKE VALVE
SEAL

Figure 11-26. Installing Valves, Cup Seals, Springs, and Retainer.

(4) Compress the valve springs and install the locks. Then release the tool.

NOTE

If the valves or seats were reground, measure the height of the installed springs, taking your measurement from the bottom of the spring seat in the cylinder head to the bottom of the spring retainer. If spacers are installed, measure from the top of the spacer. If the height is greater than 1-11/16 inches, install a 1/16-inch spacer in the head counterbore to bring the spring height back within the normal range of 1-5/8 to 1-11/16 inches.

11-9. Inspecting the Rocker Arm Assemblies.

a. Slide the rockers off the shaft. Lay them on a work bench in the same order that they are installed on the shaft, so that they may be reinstalled in their original positions.

b. Inspect the shaft and arms for damage or wear. Replace worn or damaged components.

c. Reassemble the rocker arms on the shaft in groups of two. See figure 11-27 for identification of left-side and right-side rocker arms. Position the arms on the shaft as shown in figure 11-28.

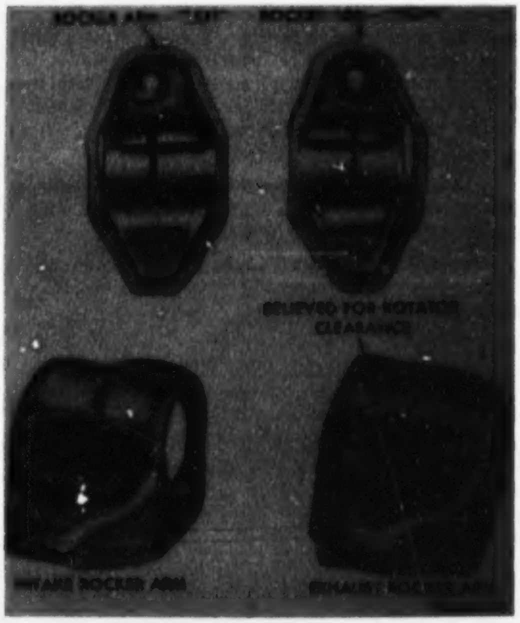

ROCKER ARM "LEFT"
RELIEVED FOR ROTATOR CLEARANCE
INTAKE ROCKER ARM
EXHAUST ROCKER ARM

Figure 11-27. Intake and Exhaust Rocker Arm Identification.

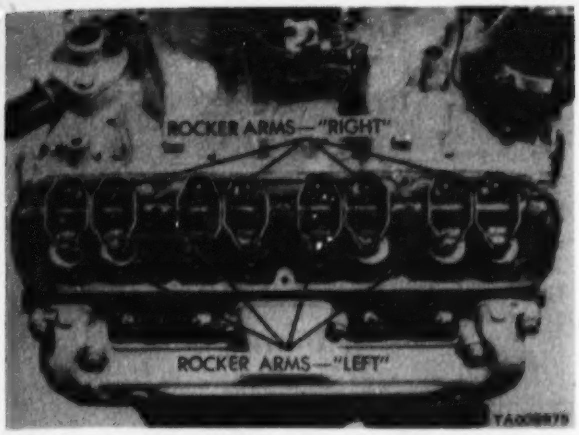


Figure 11-28. Proper Rocker Arm Location on Shaft.

11-10. Inspecting the Push Rods and Tappets.

a. Push Rods. Check for worn or bent push rods; replace as necessary.

b. Tappets. Unless new tappets (lifters) are being installed, check each tappet face for crown, using a straightedge. If you observe any negative crown (or dish), replace the tappet.

NOTE

Each used push rod and tappet must be installed in its original location. New tappets must be installed if a new camshaft is to be installed.

11-11. Servicing the Camshaft.

The camshaft has an integral gear that drives the distributor; check the gear for damage. Inspect the camshaft itself for damage, especially pits and flat spots. Measure the diameters of the journals; if they are out of specification (table 11-1), replace the camshaft.

11-12. Repair of Damaged or Worn Threads.

Refer to figure 11-29.

a. Damaged or worn threads can be repaired by using Heli-Coils or equivalent. This repair consists of drilling out worn or damaged threads, tapping the hole with a Heli-Coil tap, and installing a Heli-Coil insert into the tapped hole. This brings the hole back to its original thread size.

b. Table 11-4 lists the threaded hole sizes in the engine block. It also gives the necessary tools and inserts for repairing damaged or worn threads.

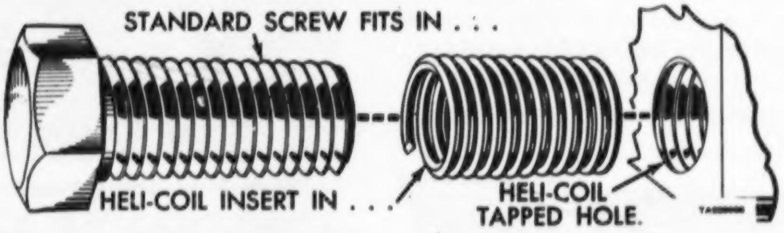


Figure 11-29. Heli-Coil or Equivalent Installation.

Table 11-4. Heli-Coil Chart

Thread size	Mopar part no.	Heli-Coil part no.	Insert length	Drill size	Tap part no. (aluminum)	Tap part no. steel & iron	Inserting tool part no.	Extracting tool part no.
10-24		1185-3CN	9/32"	13/64"	3CPB	1187-3	2288-3	1227-6
1/4-20	5-40	1185-4CN	3/8"	17/64"	4CPB	1187-4	2288-4	1227-6
5/16-18	5-41	1185-5CN	15/32"	21/64"	5CPB	42187-5	2288-5	1227-6
3/8-16	5-42	1185-6CN	9/16"	25/64"	6CPB	42187-6	2288-6	1227-6
7/16-14	5-43	1185-7CN	21/32"	29/64"	7CPB	42187-7	2288-7	1227-16
1/2-13	5-44	1185-8CN	3/4"	33/64"* 17/32"**	8CPB	42187-8	2288-8	1227-16

*In aluminum
**In cast iron or steel

Section IV. REASSEMBLY

11-13. Distributor Drive Shaft Bushing.

Use this procedure if the distributor drive shaft bushing is to be replaced. Otherwise, proceed to paragraph 11-14.

a. Removal.

(1) Insert tool C-3052 into the old bushing and thread it down until a tight fit is obtained (figure 11-30).

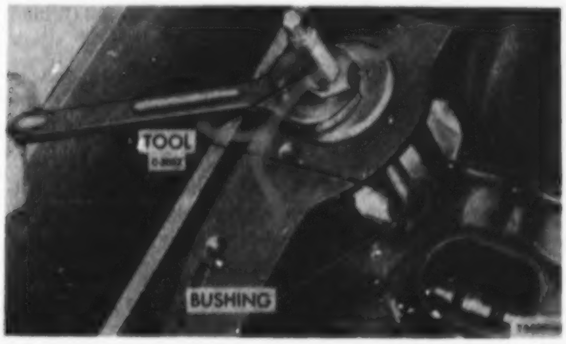


Figure 11-30. Removing Distributor Drive Shaft Bushing.

(2) Hold the puller screw and tighten the puller nut until the bushing is removed.

b. Replacement.

(1) Slide the bushing over the burnishing end of tool C-3053 and insert the tool and bushing into the bore.

(2) Drive the bushing and tool into position using a hammer (figure 11-31).

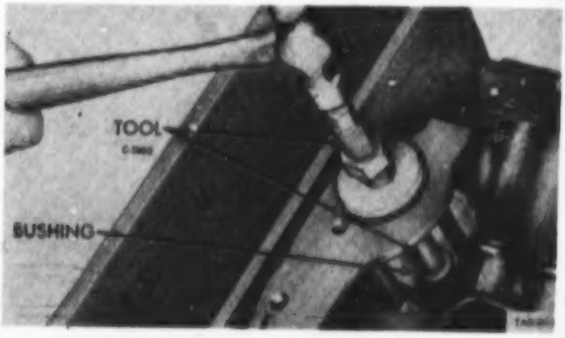


Figure 11-31. Installing Distributor Drive Shaft Bushing.

(3) Tighten the puller nut. As the burnisher is pulled through the bushing, the bushing is expanded to fit tightly in the block and is burnished to the correct size (figure 11-32). Do not ream this bushing.

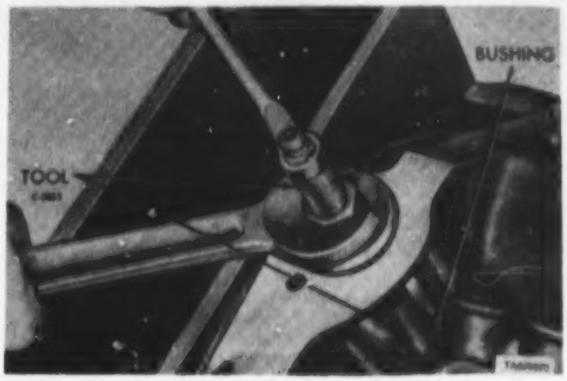


Figure 11-32. Burnishing Distributor Drive Shaft Bushing.

11-14. Camshaft.

a. General. The disassembled camshaft and sprocket assembly is shown in figure 11-33. Make sure the shaft is thoroughly lubricated prior to installation.

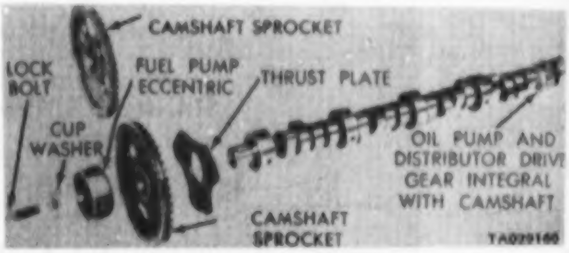


Figure 11-33. Camshaft and Sprocket Assembly.

b. Camshaft Bearings. If the camshaft bearings are not damaged, and the original camshaft is being reinstalled, the bearings do not have to be replaced. Proceed to *c*, below. If the bearings are damaged, or if a new camshaft is being installed, replace the bearings as follows:

(1) Drive out the rear cam bearing core plug.

(2) Install the proper size adapters and horseshoe washers (part of tool C-3132-**AL**) at the back of each bearing shell to be removed, and drive out the bearing shells (figure 11-34).

(3) To install new camshaft bearings, slide the new camshaft bearing shell over the proper adapter of tool C-3132-AL.

(4) Position the rear bearing in the tool. Install the horseshoe lock and carefully drive the bearing shell into place.

(5) Install the remaining bearings in the same manner.

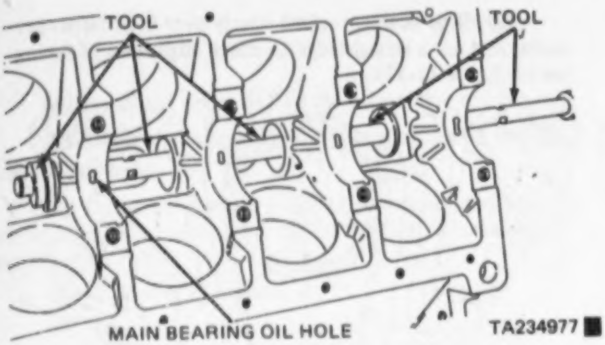


Figure 11-34. Removing Camshaft Bearings.

NOTE

> The bearing oil holes must be lined up with the oil passages from the main bearings. Also, the number two bearing must index with the oil passage to the left cylinder head and the number four bearing must index with the oil passage to the right cylinder head. If the camshaft bearing shell oil holes are not exactly alined, remove and install them correctly.

(6) Coat the core hole with sealer.

(7) Install a new core hole plug at the rear of the camshaft until it is indented 1/64 inch.

c. Installation Procedure.

(1) Lubricate the camshaft lobes and bearing journals, and insert the camshaft to within 2 inches of its final position in the cylinder block.

(2) Install tool C-3509 with the tongue in back of the distributor drive gear. Hold the tool in position with the distributor lock plate screw. This tool will keep the camshaft from being pushed in too far and knocking out the core plug in the rear of the cylinder block.

(3) Install the camshaft thrust plate and the timing chain oil tab with three screws as shown in figure 11-3. Tighten to 18 ft-lbs (210 in-lbs).

NOTE

> Make sure the tang enters the lower right hole in the thrust plate.

(4) Measure camshaft end play. If the end play is more than 0.010 inch, install a new thrust plate.

(5) Remove tool C-3509.

11-15. Crankshaft.

a. General. Refer to figure 11-35 to identify the main bearings. Bearings are available in standard and 0.010 inch undersize. When installing a new upper bearing shell, slightly chamfer the sharp edges from the plain side.

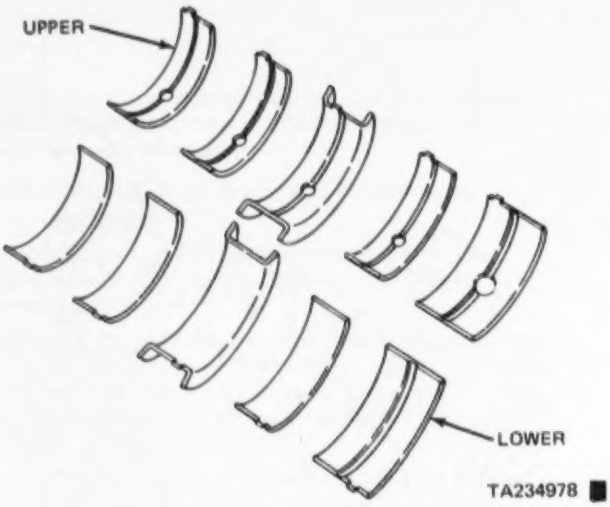


Figure 11-35. Main Bearing Identification.

b. Upper Bearing Shells. Soak the main bearing shells in OE10, then place the upper bearing shells in position in the cylinder block. The upper shells have holes that must line up precisely with the oil passages.

c. Upper Rear Main Oil Seal.

(1) Install the upper half of the rear main oil seal in the cylinder block so that both ends protrude.

(2) Position the seal, using the crankshaft.

(3) If a rope-type seal is used, cut off the portion of the seal that extends above the block on both sides.

d. Lower Bearing Shells. Install the lower bearing shells in the bearing caps.

e. Lower Rear Main Oil Seal.

(1) Install a new seal in the bearing cap so that the ends protrude.

(2) Position the seal so it is seated in the bearing cap.

(3) If a rope-type seal is used, cut off the portion of the seal that extends above the cap on both ends.

f. Bearing Caps.

(1) While holding the crankshaft in position, install the bearing caps and tighten them finger-tight only.

(2) Alternately torque all the bearing caps to 30 ft-lbs, working out from the center. Check the crankshaft for free rotation each time a cap is tightened. If the crankshaft binds, make sure the cap is seated properly and that you have installed the correct size bearing.

(3) Repeat the tightening procedure; torque to 50 ft-lbs and then to 85 ft-lbs.

g. Checking Crankshaft End Play. Measure the crankshaft end play (figure 11-36). It should be a minimum of 0.002 inch and a maximum of 0.009 inch.

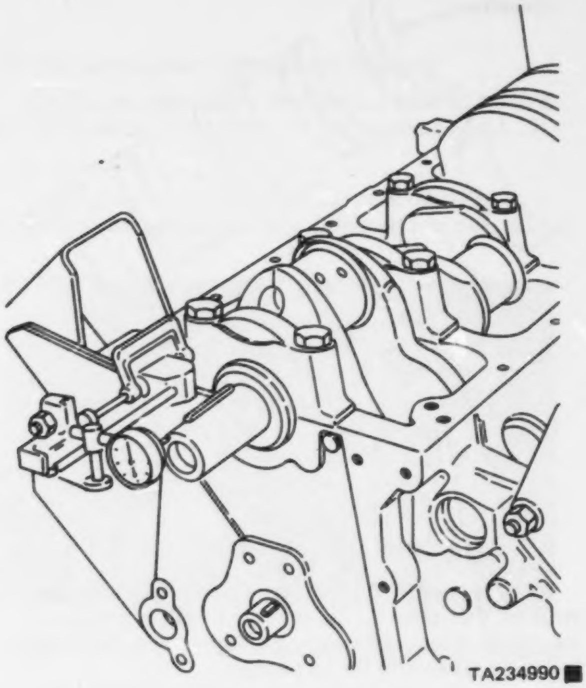


Figure 11-36. Measuring Crankshaft End Play.

h. Checking Bearing Clearances. Measure bearing clearance as follows:

(1) Smooth the edges of a 1/2- by 3/4-inch piece of brass shim stock, 0.001 inch thick.

(2) Remove the center bearing cap and lower bearing shell.

(3) Lubricate the bearing, crankshaft, and bolts. Position the shim stock across the bearing, install the cap, and tighten the bolts to 85 ft-lbs.

(4) If a slight additional drag is felt as the crankshaft is turned (moved no more than one fourth turn in either direction), clearance is 0.001 inch or less, and is considered satisfactory. If no drag is felt, the bearing is too large; if the crankshaft cannot be rotated, the bearing is too small. If the bearing clearance is not correct, replace the bearing with the next size, and repeat the check.

(5) Fit the remaining bearings in the same manner.

11-16. Timing Chain and Harmonic Balancer.

a. Timing Chain.

(1) Place both the camshaft and crankshaft sprockets on the bench with the timing marks on the exact centerline through both camshaft and crankshaft bores.

(2) Place the timing chain around both sprockets.

(3) Turn the crankshaft and camshaft to line up with the keyway location in the sprockets.

(4) Lift the sprockets and chain (keep the sprockets tight against the chain in the position described).

(5) Slide both sprockets evenly over their respective shafts, and use a straightedge to check alignment of timing marks (figure 11-37).

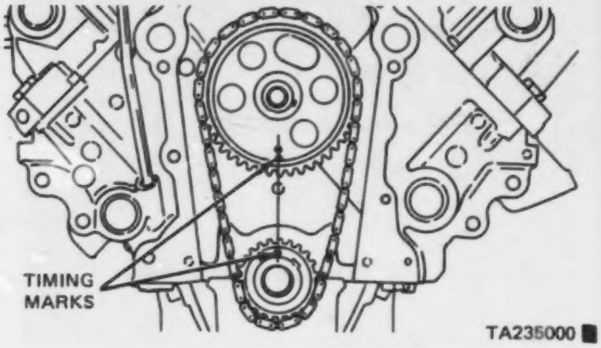


Figure 11-37. Alinement of Timing Marks.

(6) Install the fuel pump eccentric, cup washer, and camshaft bolt. Tighten the bolt to 35 ft-lbs.

(7) Using a new gasket, carefully install the chain case cover. Tighten the chain case cover capscrews to 30 ft-lbs.

b. Harmonic Balancer.

(1) Lubricate the seal lip. Position the balancer hub slot on the key in the crankshaft, and slide it on the crankshaft.

(2) Place an installing tool in position and press the harmonic balancer on the crankshaft.

(3) Install the harmonic balancer retainer bolt with a washer and tighten to 135 ft-lbs.

(4) Position the pulley on the harmonic balancer and attach it with bolts and lockwashers. Tighten to 17 ft-lbs (200 in-lbs).

11-17. Piston and Connecting Rod Assembly.

a. Preparation.

(1) Before installing pistons and connecting rod assemblies into the bore, be sure that the compression ring gaps are staggered.

(2) Before installing the ring compressor, make sure the oil ring expander ends are butted and the rail gaps are located as shown in figure 11-16.

(3) Immerse the piston head and rings in clean engine oil, slide the ring compressor over the piston, and tighten.

b. Installation.

(1) Install the upper half of the connecting rod bearing.

(2) Rotate the crankshaft so that the connecting rod journal is on the center of the cylinder bore. The notch or groove on top of the piston must be pointing toward the front of the engine.

(3) Insert the rod and piston into the cylinder bore and tap the piston down, using a hammer handle.

(4) Install the upper half of the connecting rod bearing.

(5) Guide the connecting rod into position on the crankshaft journal.

(6) Install the lower half of the connecting rod bearing into the cap. Position the cap on the rod. Alternately tighten to 45 ft-lbs.

c. *Check Bearing Clearance.*

(1) Remove the lower half of the bearing and place an oiled, 0.001-inch brass shim stock (0.5 x 0.75 in) between the bearing and the connecting rod journal.

(2) Install the bearing cap and tighten to 45 ft-lbs.

(3) Turn the crankshaft one fourth turn in each direction. If you feel a slight additional drag, the clearance is satisfactory.

(4) Side play should be from 0.006 to 0.014 inch between the two rods.

11-18. Oil Pump and Pan.

a. Install the oil pump drive shaft.

b. Prime the oil pump with engine oil. Install the oil pump and pickup screen.

c. Install the oil pan with a new gasket. Tighten the oil pan capscrews to 17 ft-lbs. Check to make sure the drain plug is tight.

11-19. Cylinder Heads.

a. Coat the new gaskets lightly with sealer and install them on the cylinder block.

b. Place the cylinder heads on the engine block.

c. Install the cylinder head bolts. Tighten them to 50 ft-lbs in the sequence shown in figure 11-38. Then, repeating the sequence, tighten the bolts to 95 ft-lbs.

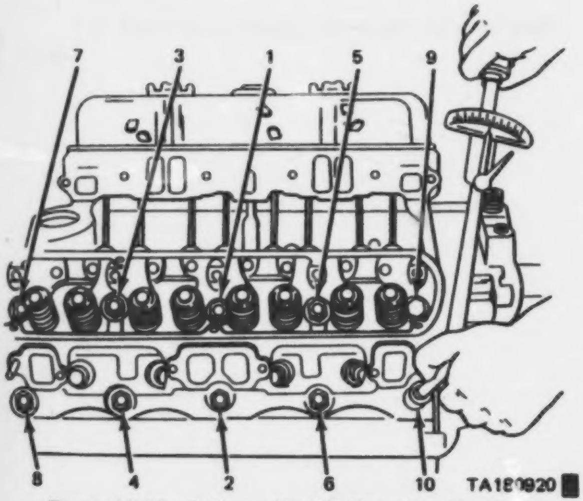


Figure 11-38. Cylinder Head Tightening Sequence.

d. Cut the 3 inch strip of sealer material into four equal parts and install them under the intake manifold lock tabs. Do not use sealer or cement.

11-20. Tappets, Push Rods, and Rocker Arm Assemblies.

a. Install the tappets. Used tappets must go in their original location. If a new camshaft was installed, use all new tappets.

b. Install the push rods and rocker arm shaft assemblies. Used push rods must go in their original location. The notch on the end of the rocker arm shaft must point to the centerline of the engine and face forward on the left bank and to the rear on the right bank.

c. Install the retainers. The longer retainers go in the number two and four positions. Tighten all retainers to 18 ft-lbs.

11-21. Intake and Exhaust Manifolds.

a. *Intake Manifold.*

(1) Position the rubber seals for the intake manifold over the rails at the front and rear of the cylinder block. The center hole in the seals must engage the dowel pins and end holes locked in the tangs of the head gasket.

(2) Install new intake manifold side gaskets with the bead down.

(3) Carefully lower the intake manifold into position on the cylinder block and cylinder heads. After the intake manifold is in place, inspect it to make sure the seals are in place.

(4) Install the attaching capscrews finger-tight. Tighten the capscrews to 25 ft-lbs in the tightening sequence shown in figure 11-39. Retighten the capscrews to 35 ft-lbs in the same sequence.

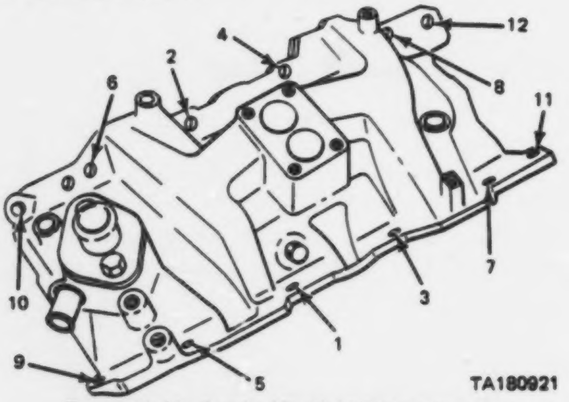


Figure 11-39. Intake Manifold Tightening Sequence.

b. Exhaust Manifolds.

(1) Place manifolds on the two studs on the cylinder head.

(2) Put the conical washers and nuts on the studs.

(3) Put two screws with conical washers inside the ends of the outer arms of the manifolds.

(4) Tighten all screws and nuts to 25 ft-lbs starting at the center arm and working out.

(5) Check the heat riser valve on the right manifold for free movement; if it binds, apply solvent to both ends of the shaft and work it back and forth until it operates freely.

11-22. Remaining Components.

a. General. The sequence shown in *b*, below is correct for mounting the remaining components on the engine. Detailed procedures, if required, may be found in part two of this manual or in TM 9-2320-266-20.

b. Sequence of Installation.

(1) Water pump.

(2) Fuel pump.

(3) Oil filter.

(4) Ignition coil.

(5) Thermostat and housing.

(6) Choke element (mounted on intake manifold).

(7) Pulley, spacer, and fan.

(8) Alternator bracket, alternator, and fan belt. Adjust belt tension for 1/2 to 3/4 inch deflection under firm pressure Tighten the alternator mounting bolt to 30 ft-lbs. Tighten the adjusting strap bolt to 17 ft-lbs.

(9) Temperature and oil pressure gage sending units.

(10) Distributor assembly. Set ignition timing (TM 9-2320-266-20).

(11) Spark plugs (gapped to 0.035 inch) and spark plug wires.

CHAPTER 12

REPAIR OF THE CARBURETOR

12-1. Specifications.

Specifications for the carburetor are listed in table 12-1.

Table 12-1. Carburetor Specifications.

Carter model number	BBD-6537S
Engine displacement (cu in)	318
Transmission	Automatic
Bore	1-7/16 in
Venturi	1-3/16 in
Main metering jets	
Standard	120-392
Metering rods (standard)	2092
Adjustments	
Step-up piston gap	0.035 in
Float setting (at center of floats)	1/4 in
Accelerator pump setting	0.500 in

12-2. Disassembling the Carburetor.

a. General. The carburetor has three main units: the air horn, the main body, and the throttle body. Be careful not to damage the throttle valves.

b. Procedures.

(1) Break the carburetor down into its three major units.

(2) Remove the brass air valve and seat, and the valve spring, by unscrewing the seat from the air horn.

(3) Remove the retaining clip from the accelerator pump arm link and remove the link.

Figure 12-1. Deleted.

(4) Remove the step-up piston cover plate and gasket from the top of the air horn (figure 12-2).

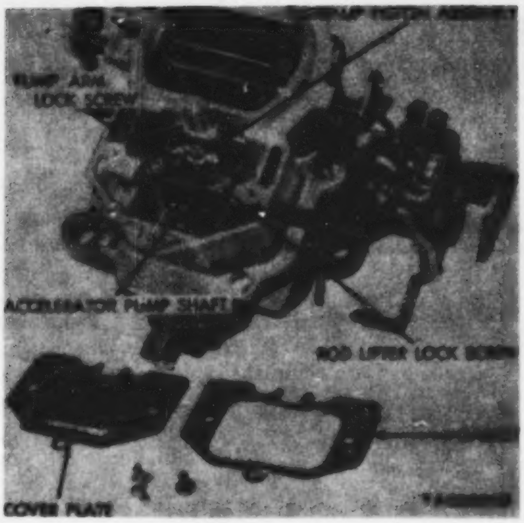

STEP-UP PISTON ASSEMBLY
PUMP ARM LOCK SCREW
ACCELERATOR PUMP SHAFT
ROD LIFTER LOCK SCREW
COVER PLATE

Figure 12-2. Removing the Step-Up Piston Cover Plate.

(5) Remove the screws and locks from the accelerator pump arm and the vacuum piston rod lifter. Then slide the pump lever out of the air horn (figure 12-3).

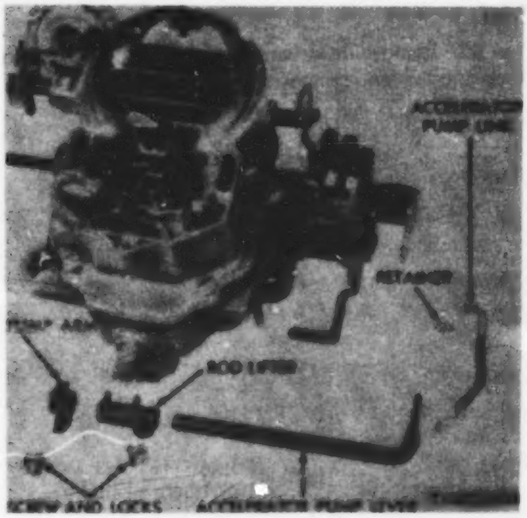

ACCELERATOR PUMP LINK
RETAINER
PUMP ARM
ROD LIFTER
SCREW AND LOCKS
ACCELERATOR PUMP LEVER

Figure 12-3. Removing or Installing the Accelerator Pump Lever.

(6) Lift the vacuum piston and step-up rods straight up and out of the air horn as an assembly (figure 12-4).

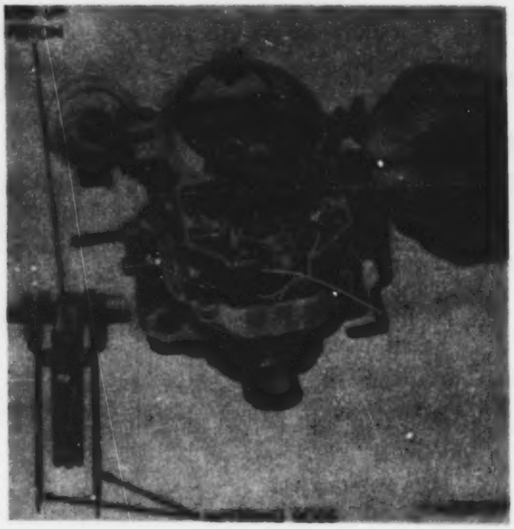


Figure 12-4. Removing or Installing the Step-Up Piston Assembly

(7) Remove the vacuum hose from between the carburetor main body and the choke vacuum diaphragm.

(8) Remove the choke diaphragm, linkage, and bracket assembly and place it to one side to be cleaned as a separate item.

(9) Remove the fast-idle cam retaining screw to release the fast-idle cam and linkage. Remove these parts.

(10) Remove the air horn retaining screws and lift the air horn straight up and away from the main body as shown in figure 12-5. Discard the gasket.

(11) Turn the air horn over and push the spring down to remove the "S" link from the pump shaft. Remove the pump assembly.

(12) Remove the fuel inlet needle valve, the seat, and the gasket from the main body.

NOTE

Don't remove the idle orifice tubes or the main vent tubes from the cluster. They can be cleaned in a solvent and dried with compressed air.

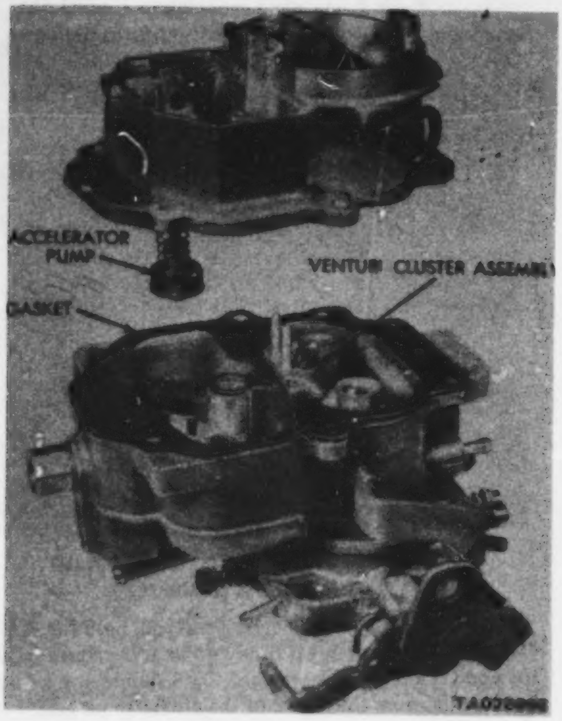

ACCELERATOR
PUMP
VENTURI CLUSTER ASSEMBLY
GASKET
TA0

Figure 12-5. Removing or Installing the Air Horn.

(13) Lift out the float retainer and baffle. Remove the floats and pin (figure 12-6).

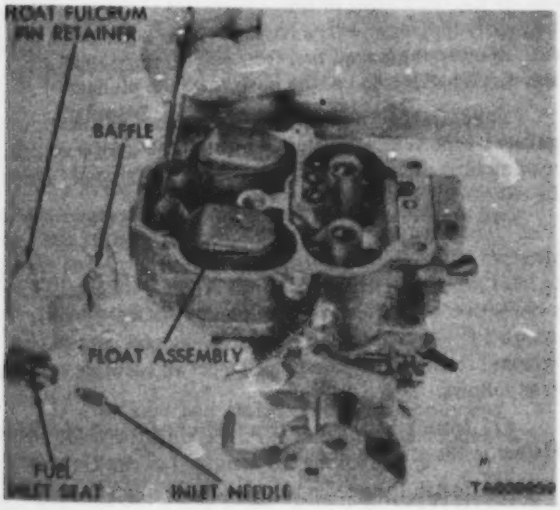

FLOAT FULCRUM
PIN RETAINER
BAFFLE
FLOAT ASSEMBLY
FUEL
INLET SEAT
INLET NEEDLE
TA0

Figure 12-6. Removing or Installing the Float Assembly.

(14) Remove the main metering jets (figure 12-7).

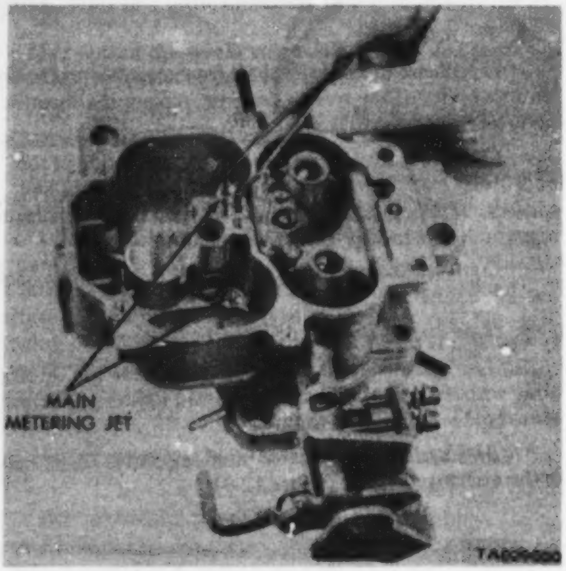

MAIN
METERING JET
TA0

Figure 12-7. Removing or Installing the Main Metering Jets.

(15) Remove the venturi cluster screws to lift the venturi cluster and gaskets up and away from the main body (figure 12-8). Discard the gaskets.

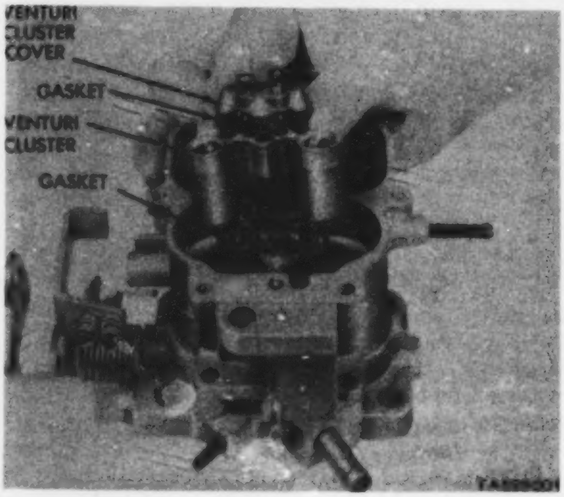

VENTURI
CLUSTER
COVER
GASKET
VENTURI
CLUSTER
GASKET
TA0

Figure 12-8. Removing or Installing the Venturi Cluster.

(16) Remove the accelerator pump discharge and intake check balls.

(17) Remove the plastic limiter caps from the idle mixture screws. Remove the screws and springs from the throttle body.

(18) Remove the screws and separate the throttle body from the main body.

(19) Clean all metal parts and thoroughly dry with compressed air prior to reassembly.

12-3. Inspecting and Reassembling the Carburetor.

a. Throttle Body.

(1) Check the throttle shaft for excessive wear in the throttle body. If the wear is extreme, replace the throttle body assembly.

(2) Install the idle mixture screw and spring in the body. Make sure that the tapered portion is straight and smooth. If it is grooved or ridged, install a new idle mixture screw to insure having correct idle mixture control.

(3) Turn the screws lightly until they seat; then back out 1-1/2 turns.

b. Main Body.

(1) Place the insulator in position. Aline the throttle body with the main body and install and tighten the screws securely.

(2) Install the accelerator pump discharge check balls in the discharge passage (figure 12-9).

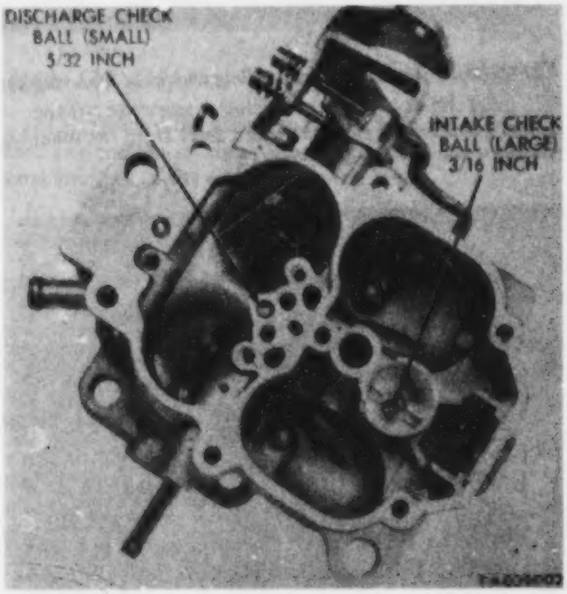

DISCHARGE CHECK BALL (SMALL) 5/32 INCH
INTAKE CHECK BALL (LARGE) 3/16 INCH
TA029002

Figure 12-9. Installing the Accelerator Pump Intake and Discharge Check Balls.

(3) Drop the accelerator pump intake check ball into the bottom of the pump cylinder.

(4) Check the accelerator pump system and the fuel inlet and discharge ball check valves as follows:

(a) Pour clean gasoline into the carburetor bowl, approximately 1/2-inch deep. Slide the pump plunger into the cylinder. Raise the plunger and press lightly on the shaft to expel the air from the pump passage.

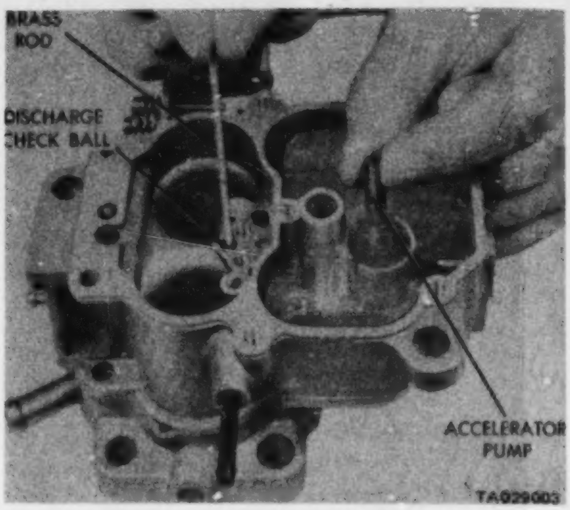


Figure 12-10. Testing the Accelerator Pump Intake and Discharge.

(b) Using a small clean brass rod, hold the discharge check ball down firmly on its seat. Again raise the plunger and press downward. You should not see any fuel coming from the intake or the discharge passage (figure 12-10).

(c) If fuel is discharged, it means there is dirt in the system or there is a damaged check ball or seat. Clean the passage again and repeat the test.

(d) If there is still leakage, stake the check ball seats by placing a piece of drill rod on top of the check ball and lightly tapping it with a hammer. This will form a new seat. Remove the leaked fuel from the bowl through the inlet check ball located at the bottom of the plunger.

(e) Install the discharge check ball. Put new gaskets on the venturi cluster and install the cluster in position in the main body (figure 12-8). Install and tighten the cluster screws securely.

c. Checking the Float Setting. The carburetors are equipped with a rubber-tipped fuel inlet needle. The needle tip is a rubber material which is not affected by gasoline and is stable over a wide range of temperatures. It is flexible enough to make a good seal on the needle seat, and to give increased resistance to flooding. To get an accurate setting, do as follows:

(1) Install the floats with a fulcrum pin and pin the retainer in the main body.

(2) Install the needle, seat, and gasket in the body. Tighten them securely.

(3) Turn the main body over, catching the pump intake check ball, so that only the weight of the floats is forcing the needle against the seat. Hold your finger against the retainer to fully seat the fulcrum pin.

(4) Using a straightedge scale, check the float setting. The measurement from the top surface of the fuel bowl to the crown of each float at the center (figure 12-11) should be one-quarter inch.

(5) If an adjustment is necessary, hold the floats on the bottom of the bowl and bend the float lip toward or away from the needle. Recheck the setting again. Then repeat the lip bending operation as required.

CAUTION

Do not apply pressure to the float. If the synthetic rubber needle valve tip is compressed too much it can cause a false setting and will affect the correct level of the fuel in the bowl.

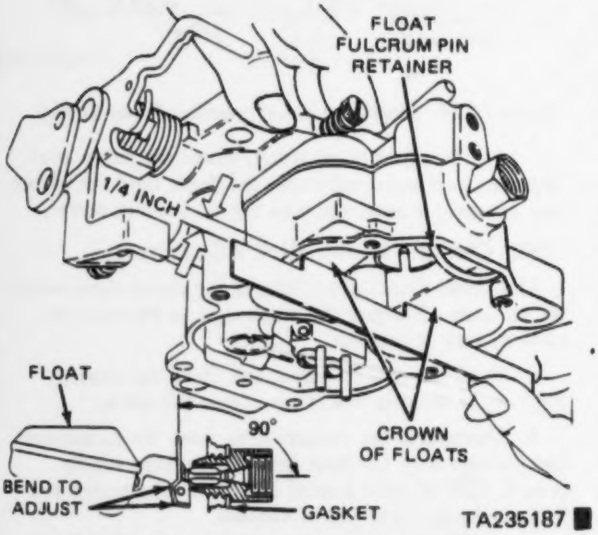


Figure 12-11. Checking the Float Setting.

d. Air Horn.

(1) Place the accelerator pump drive spring on the pump plunger shaft and insert the shaft into the air horn. Push the spring down far enough to insert the "S" link.

(2) Drop the intake check ball into the pump bore.

(3) Install the baffle into the main body.

(4) Place the step-up piston spring in the piston vacuum bore.

(5) Position a new gasket on the main body and install the air horn. Tighten the retaining screws alternately, a little at a time, to compress the gasket evenly.

(6) Check the gap in the vacuum piston as specified in paragraph 12-4.

(7) Position the vacuum piston metering rod assembly into the bore in the air horn, making sure the metering rods are in the main metering jets.

(8) Place the two lifting tangs of the plastic rod lifter under the piston yoke.

(9) Slide the shaft of the accelerator pump lever through the rod lifter and the pump arm.

(10) Install the two locks and the adjusting screws, but don't tighten them.

(11) Install the accelerator pump arm so that the operating "S" link is in the outer hole.

(12) Install the fast idle cam and linkage, and tighten the retaining screw.

(13) Connect the accelerator pump linkage to the pump lever and throttle lever and install the retaining clip.

e. Choke Vacuum Diaphragm. Make sure the diaphragm vacuum fitting is not plugged with foreign material. Check for internal leaks by depressing the diaphragm stem and putting your finger over the vacuum fitting to seal the opening. Then let go of the diaphragm stem. If it moves more than 1/16-inch in 10 seconds, the assembly is leaking excessively and must be replaced. To install a new diaphragm assembly on the air horn do the following:

(1) Engage the choke link in its slot in the choke lever.

(2) Install and attach the diaphragm assembly.

(3) Inspect the rubber hose for cracks before placing it on the correct carburetor fitting. Don't connect the vacuum hose to the diaphragm fitting until you have made the vacuum kick adjustment (paragraph 12-4).

(4) Loosen the choke valve attaching screws slightly. Press your fingers on the high side of the valve to hold it closed. Then tap it lightly with a screwdriver to seat it in the air horn. Tighten the screws and stake them.

(5) Install the idle enrichment valve assembly, placing the valve in the seat with the spring inside the air valve. Insert the threaded end of the assembly into the threaded hole in the air horn and tighten it. Position the diaphragm return spring in the cup in the center of the diaphragm and cover it with the vacuum nipple. Secure it with three screws.

12-4. Adjusting the Carburetor.

Make the following adjustments in the sequence listed.

a. Adjusting the Vacuum Step-Up Piston. The carburetor doesn't need to be completely disassembled to remove the step-up piston metering rod assembly. However, if the assembly is removed or the mechanical rod lifter adjustment is disturbed, the step-up piston must be readjusted into the central position.

(1) Adjust the gap in the step-up piston (figure 12-12) by turning the allen head screw on top of the piston. The gap should be 0.035 inch.

(2) Install the metering rods in the holes in the piston yoke. Be sure the rods are straight and free of nicks or burrs.

(3) Install the step-up piston assembly in the bore in the air horn, making sure the metering rods are positioned in the metering jets.

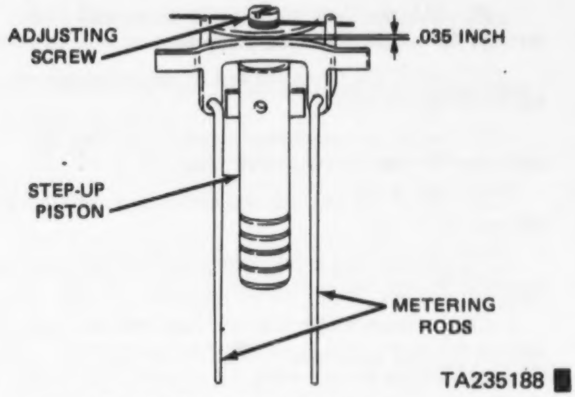


Figure 12-12. Step-Up Piston.

(4) Press the step-up piston all the way down and push moderately on the rod lifter tab so that you can tighten the rod lifter lock screw (figure 12-13).

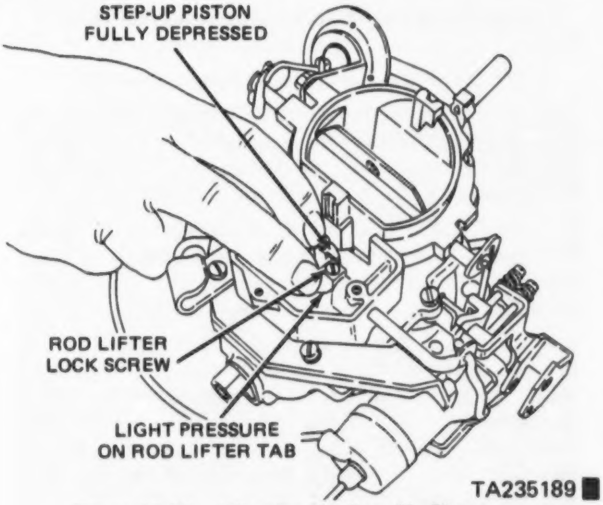

STEP-UP PISTON FULLY DEPRESSED
ROD LIFTER LOCK SCREW
LIGHT PRESSURE ON ROD LIFTER TAB
TA235189

Figure 12-13. Adjusting the Step-Up Piston.

b. Adjusting the Accelerator Pump Stroke. Determine the accelerator pump stroke by measuring the distance from the air horn surface down to the top of the accelerator pump shaft at the idle screw. To establish an approximate idle on newly assembled carburetors, do the following:

(1) Back off the idle speed adjusting screw to completely close the throttle valve. The fast idle cam must be in the open choke position.

(2) Turn the idle screw clockwise until it just contacts the stop.

(3) Continue to turn two complete turns.

c. Adjusting the Accelerator Pump.

(1) Be sure the accelerator pump "S" link is in the outer hole of the pump arm.

(2) Measure the distance between the surface of the air horn and the top of the accelerator pump shaft (figure 12-14). The accelerator pump setting at idle should be one-half inch.

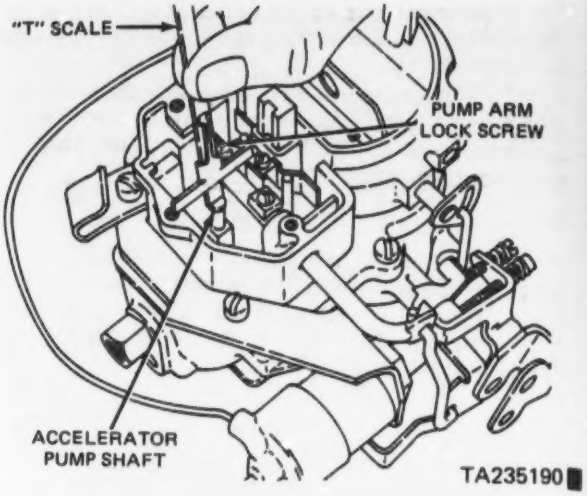


Figure 12-14. Measuring the Accelerator Pump Stroke.

(3) To adjust pump travel, loosen the pump arm adjusting lock screw and rotate the sleeve until the proper measurement is obtained; then tighten the lock screw.

12-5. Choke Vacuum Kick Adjustment.

The choke diaphragm positions the choke valve within the air horn. Energize the diaphragm to measure the vacuum kick adjustment.

a. Open the throttle valves and close the choke. Release the throttle first, then release the choke.

b. Disconnect the vacuum hose from the carburetor and connect it to the hose from the vacuum supply (tool C-4207-A) with a small length of tube acting as a fitting. Apply 15 inches of vacuum.

c. Insert a 0.110-inch feeler gage between the choke valve and the wall of the air horn (figure 12-15). Apply sufficient closing pressure on the lever to which the choke rod attaches to provide a minimum choke valve opening without distorting the diaphragm link. The cylindrical stem of the diaphragm link will extend as the internal spring is compressed. This spring must be fully compressed to measure the vacuum kick adjustment.

BEND HERE
TO ADJUST

Figure 12-15. Adjusting Choke Vacuum Test.

12-6. Choke Unloader (Wide Open Kick).

The choke unloader is a mechanical device that partially opens the choke valve at wide open throttle. It is used to eliminate choke enrichment when cranking the engine. Engines which have been flooded or stalled are cleared by using the unloader. Adjust it as follows:

a. Hold the throttle in the wide open position. Insert a 0.310 inch feeler gage between the upper edge of the choke valve and the inner wall of the air horn.

b. Press a finger lightly against the choke lever. You should feel a slight drag as the gage is withdrawn. If an adjustment is necessary, bend the unloaded tang on the throttle lever to the correct opening.

12-7. (Deleted.)

Figure 12-16. Deleted.

CHAPTER 13

REPAIR OF THE DISTRIBUTOR

13-1. Disassembling the Distributor.

Refer to figure 13-1.

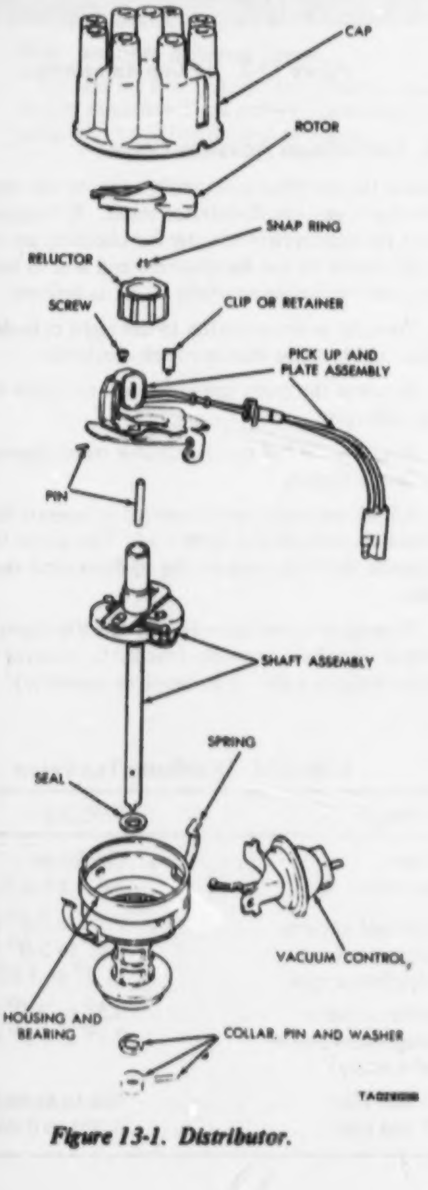


Figure 13-1. Distributor.

a. Remove the distributor rotor.

b. Remove the two screws and lockwashers attaching the vacuum control unit to the distributor housing. Disconnect the vacuum control arm from the upper plate and remove the control.

c. Remove the reluctor by prying it up from the bottom with two pry bars or screwdrivers. Be careful not to distort or damage the teeth on the reluctor.

d. Remove the two screws and lockwashers attaching the lower plate to the housing. Lift out the lower plate, upper plate, and pickup coil as an assembly. If a dial indicator shows more than 0.006 inch shaft side play, replace the housing or shaft, the reluctor sleeve, and the governor weights as an assembly.

(1) Remove the distributor shaft retaining pin and slide the retainer off the end of the shaft.

(2) Use a file to clean burrs from around the pin hole in the shaft and remove the lower thrust washer.

13-2. Assembling the Distributor.

Refer to figure 13-1.

a. Test the operation of the governor weights and inspect the weight springs for distortion.

b. Lubricate the governor weights.

c. Inspect all bearing surfaces and pivot pins for roughness, binding, or excessive looseness.

d. Lubricate and install the upper thrust washer (or washers) on the shaft and slide the shaft into the distributor body.

e. Install the distributor shaft retainer and pin.

f. Install the lower plate, upper plate, and pickup coil assembly. Install the attaching screws.

g. Attach the vacuum advance unit arm to the pickup plate.

h. Install the vacuum unit attaching screws and washers.

i. Position the reluctor keeper pin into place on the reluctor sleeve.

j. Slide the reluctor down the reluctor sleeve and press firmly into place. Install the reluctor so that the two arrows are on top.

k. Lubricate the felt pad in the top of the reluctor sleeve with one drop of engine oil and install the rotor.

13-3. Removing the Pickup Coil.

a. Remove the reluctor by prying it up from the bottom with two pry bars or screwdrivers.

CAUTION

Be careful not to damage the reluctor teeth.

b. Remove the two screws attaching the vacuum control unit to the distributor housing.

c. Disconnect the vacuum control arm from the pickup coil and plate assembly and remove the control unit.

d. Remove the pickup coil leads from the distributor housing.

e. Remove the two screws attaching the lower plate to the distributor housing.

f. Lift the pickup coil and plate assembly out of the housing.

g. Separate the pickup coil and plate assembly from the lower plate by depressing the retainer clip in the underside of the lower plate and moving it away from the attaching stud. The pickup coil is not removable from the plate.

13-4. Installing the Pickup Coil.

a. Place a small amount of distributor cam lubricant on the upper plate support pins located on the lower plate.

b. Position the upper plate on the lower plate. Install the retainer clip and depress and lock into place.

c. Position the lower plate, the upper plate, and the pickup coil assembly in the distributor housing. Install the mounting screws and tighten them securely.

d. Attach the vacuum control arm to the upper plate. Position the control into place on the distributor housing. Install the mounting screws and tighten them securely.

e. Install the pickup coil leads to the distributor housing.

f. Install the reluctor. Refer to paragraph 13-2 for correct installation procedures.

13-5. Air Gap Adjustment.

Refer to figure 13-2.

a. Position a reluctor tooth directly in line with the pickup coil tooth.

b. Loosen the pickup coil hold-down screw.

c. Adjust the air gap to 0.008 inch, using a non-magnetic feeler gage (tool C-4229).

d. Tighten the hold-down screw.

e. Recheck the air gap with a 0.010 feeler gage. A 0.010 feeler gage should not fit into the air gap.

f. Apply vacuum to the vacuum unit and rotate the governor shaft. The pickup pole should not hit the reluctor teeth. If hitting occurs on the reluctor, the distributor shaft is bent. Replace the shaft assembly.

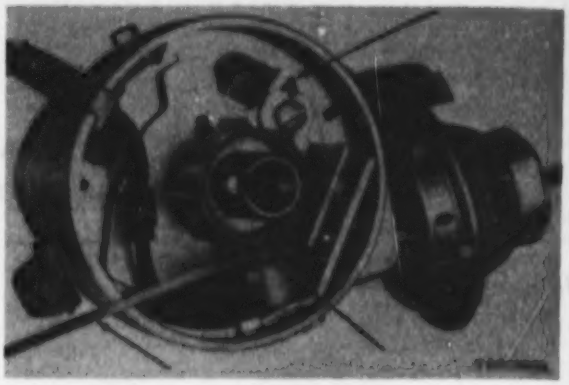


Figure 13-2. Air Gap Adjustment.

13-6. Centrifugal Advance Curve.

Mount the distributor assembly without the cap and rotor in a stroboscope-type distributor tester. It is important to connect the appropriate adapter for checking an electronic-type distributor to the distributor stand and to follow the instructions for its use carefully. Test as follows:

a. Turn the selector switch to the eight cylinder position and turn the motor switch clockwise.

b. Regulate the tester speed control to rotate the distributor at 200 rpm.

c. Aline the "0" of the distributor tester degree with any of the arrow flashes.

d. Adjust the tester speed control to operate the distributor at speeds called for in table 13-1. The arrow flashes must be opposite the tester degree ring to determine the degree of advance.

e. If advance is not according to specifications, replace the distributor shaft assembly (the shaft, reluctor sleeve, and governor weights make up a complete assembly).

Table 13-1. Distributor Test Points

Part number	3755201
Rotation	Clockwise
Firing order.	1-8-4-3-6-5-7-2
Centrifugal advance . . . . . (degrees at distributor rpm)	0.5° to 3.0° @ 550 2.5° to 5.0° @ 700 11.5° to 14.0° @ 2150
Vacuum advance . . . . (degrees at inches of mecury)	0.5° to 2.5° @ 10 in 7.5° to 9.5° @ 15 in
Shaft side play.	Not to exceed 0.006 in
Shaft end play	0.003 to 0.017 in

13-7. Vacuum Diaphragm Leak Test.

With the vacuum unit attached to the distributor and mounted in the distributor tester, proceed as follows:

a. Place your thumb over the end of the vacuum pump and hose and adjust the regulator control knob to give a reading of 20 inches. The hose must be closed off to be sure the tester hose does not leak.

b. Attach the tester vacuum pump hose to the tube on the distributor vacuum unit. The vacuum gage reading will hold if no leaks exist.

c. Observe the contact plate while performing the leak test to test the response of the contact plate. There should be instant response to the pull of the diaphragm, moving the plate without a drag or bind.

d. If leakage is indicated, replace the vacuum unit assembly.

13-8. Vacuum Advance Curve.

Connect the tester vacuum pump hose to the distributor vacuum advance unit and perform operations *a* through *c* in paragraph 13-6. Then proceed as follows:

a. Turn the tester vacuum pump on. Adjust the vacuum pump regulator to vacuum test specifications as shown on table 13-1.

b. If the vacuum advance is above or below specifications, replace the vacuum advance unit. Retest the vacuum advance curve.

13-9. Test Stand Operation.

Test the distributor on the engine distributor test stand in accordance with the operating procedures for the test stand.

NOTE

It will be necessary to use the distributor pulse amplifier (DPA) when using the Sun Electric Corporation models that are not battery operated. This will amplify the low level signal of the transistor ignition system so that it can energize the test stand circuits.

CHAPTER 14

REPAIR OF THE ALTERNATOR

14-1. Rotor Field Coil Current Draw Test.

a. Connect a jumper wire between one field terminal of the alternator and the positive terminal of a fully charged battery. Connect a test ammeter positive lead to the other field terminal of the alternator. The negative ammeter lead goes to the battery negative terminal.

b. Slowly rotate the alternator rotor by hand. Observe the ammeter reading. Field coil draw should be 2.5 amps to 3.7 amps at 12V.

c. A low rotor coil draw is an indication of high resistance in the field coil circuit (brushes, slip rings, or rotor coil). A higher rotor coil draw indicates a possible shorted rotor coil or grounded rotor. No reading indicates an open rotor or defective brushes.

14-2. Disassembling the Alternator and Separating the Alternator and Shields.

a. General. Remove the brush assemblies before separating the end shields to prevent damage. The field brushes are positioned against the slip rings of the rotor.

b. Disassembly Procedure.

(1) Remove the brush screws and insulating washers and lift the brush assemblies from the end shield (figure 14-1).

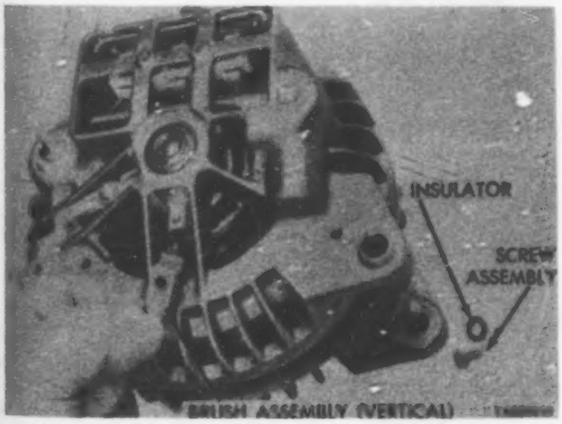


Figure 14-1. Removing Field Brushes.

CAUTION

Do not burr the laminated stator or the end shield.

(2) Remove the through bolts and pry between the stator and the drive end shield with the blade of a screwdriver (figure 14-2). Carefully separate the drive end shield, pulley, and rotor assembly from the stator and rectifier end shield assembly.

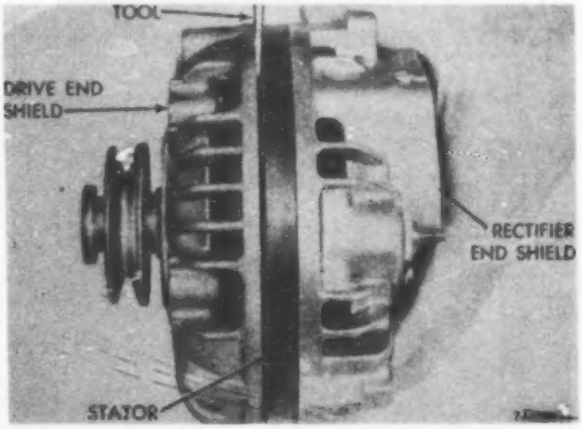


Figure 14-2. Separating Drive End Shield from Stator.

14-3. Component Tests.

a. Testing the Rectifiers. There are two rectifier plates in the rectifier end shield. One is positive and the other is negative in polarity. The following test procedure applies to both plates.

(1) Remove the nuts from the terminal block studs that secure the stator windings. Remove the nuts securing the positive and negative rectifier straps to the block. See figure 14-3.

(2) Lift off the stator winding terminals and carefully pry the stator assembly from the end shield.

(3) Test the rectifiers using the ohmmeter portion of the multimeter. Contact the heat sink of a rectifier plate with one test probe; contact the strap on top of the individual rectifier with the other test probe (figure 14-4).

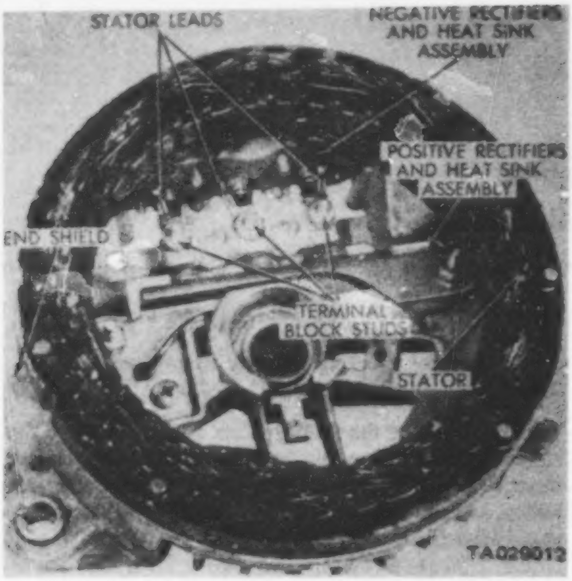

STATOR LEADS
NEGATIVE RECTIFIERS AND HEAT SINK ASSEMBLY
POSITIVE RECTIFIERS AND HEAT SINK ASSEMBLY
END SHIELD
TERMINAL BLOCK STUDS
STATOR
TA029012

Figure 14-3. Rectifier End Shield and Stator Assembly.

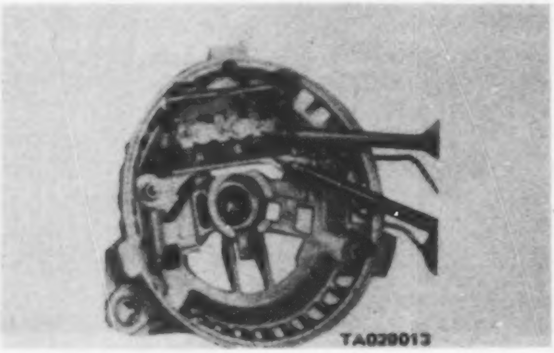


Figure 14-4. Testing Rectifiers with Ohmmeter.

(4) Reverse the probes, moving the probe on the rectifier heat sink to the rectifier strap and vice versa. If you have high resistance in one direction and low resistance in the other, the rectifier is okay. If you have low resistance in both directions, the rectifier is shorted. If you have high resistance in both directions, the rectifier is open.

(5) Repeat the above procedure for all rectifiers in both assemblies. Replace any rectifier plate that has an open or shorted rectifier (paragraph 14-4).

(6) All three rectifiers on a plate should have low resistance readings in the *same* direction. If one reads low in the opposite direction, it is the wrong polarity rectifier. Replace the rectifier plate.

b. Testing the Stator.

(1) Press one ohmmeter test probe firmly onto any pin in the stator frame (figure 14-5). Be sure the varnish has been removed so that the pin is bare.

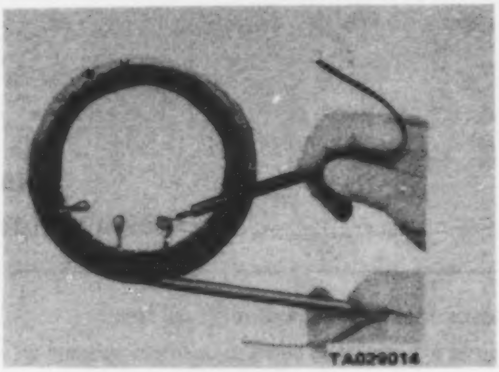


Figure 14-5. Testing Stator for Ground.

(2) Press the other test probe firmly to each of the three phase (stator) lead terminals, one at a time. If you get a low resistance reading, the stator lead is grounded.

(3) Press one test probe to one phase terminal lead. Touch the other probe to each of the other two stator leads. The meter should indicate low resistance when the probe contacts each of the terminals. If it does not, the stator winding is open.

(4) Install a new stator if the old one is grounded or open.

c. Testing the Rotor for Shorts, Grounds, or Opens. Use an ohmmeter to check the rotor assembly for grounded, open, or shorted field coils (figures 14-6 and 14-7).

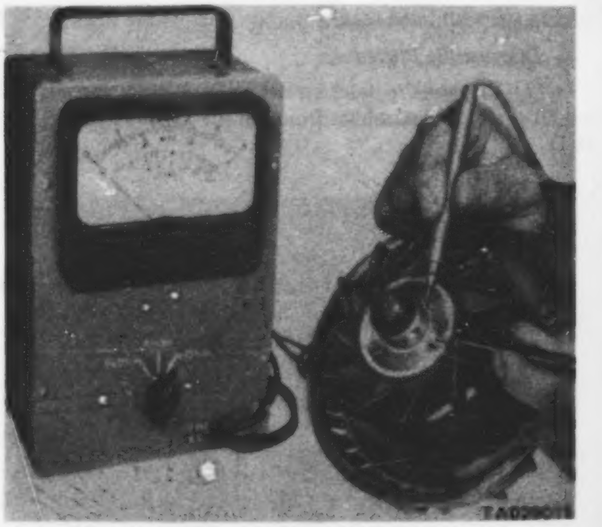


Figure 14-6. Rotor Test.

(1) Test for ground. To check for a grounded field coil, first zero the ohmmeter. Then connect the test leads from each slip ring to the rotor shaft. The ohmmeter should read infinite at each slip ring. If the reading is less than infinite, the rotor is grounded.

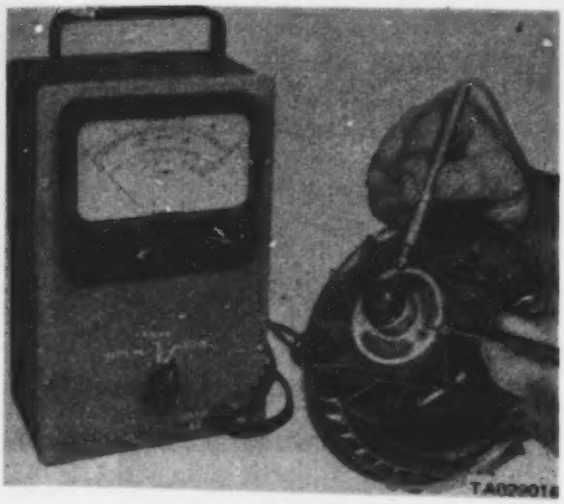


Figure 14-7. Rotor Test.

(2) Test for open. To check for an open field coil, connect an ohmmeter to the slip rings. The ohmmeter reading should be between 3 and 4 ohms on the rotor coils.

(3) Test for short. To check for a shorted field coil, connect an ohmmeter to the two slip rings. If the reading is below 3 ohms, replace the field coil.

14-4. Replacing the Rectifiers, Pulley, and Bearing.

a. Replacing Negative Rectifier Plates.

(1) Loosen the four hexagon-head screws that secure the rectifier plate to the rectifier end shield. Completely remove the two outer screws and lift the plate out of the end shield (figure 14-8).

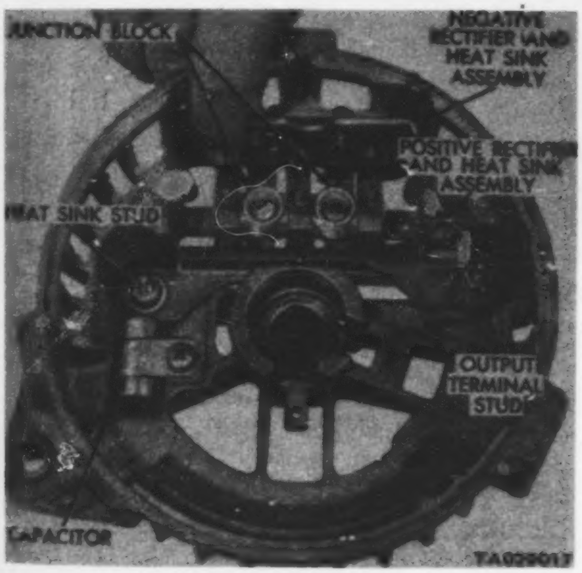

JUNCTION BLOCK
NEGATIVE RECTIFIER (AND HEAT SINK ASSEMBLY
POSITIVE RECTIFI AND HEAT SINK ASSEMBLY
EAT SINK STUD
OUTPUT TERMINAL STUD
CAPACITOR
TA029017

Figure 14-8. Removing Negative Rectifier Plate.

(2) To install a new negative plate, reverse the above procedure.

b. Replacing Positive Rectifier Plates.

(1) Remove the two nut and washer assemblies securing the rectifier plate to the insulated terminals in the rectifier end shield. Remove the screw grounding the capacitor to the case. Lift out the insulated washer, the capacitor, and the positive rectifier plate.

(2) To install a new positive plate, reverse the above procedure.

c. Removing the Pulley and Bearing.

(1) The pulley is pressed on the rotor shaft. Remove the pulley with puller tool C-4068 (figure 14-9).

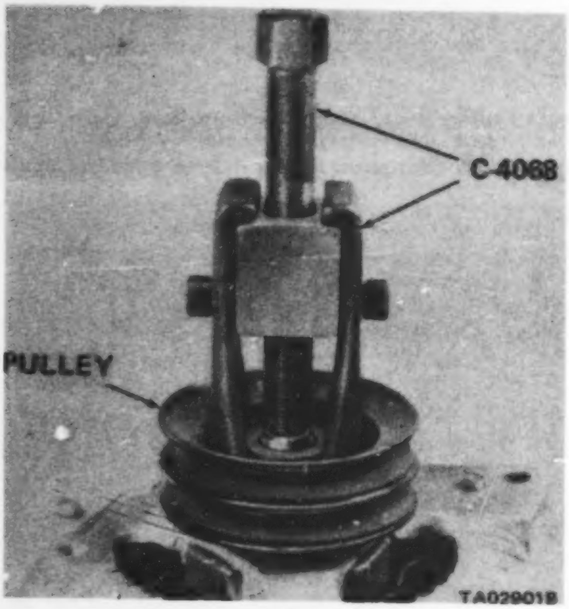


Figure 14-9. Removing Pulley.

(2) Pry the drive end bearing retainer from the end shield (figure 14-10).

(3) Support the end shield and tap the rotor shaft with a plastic hammer to separate the rotor from the end shield.

(4) The drive end ball bearing is pressed on the rotor shaft. Remove the bearing with puller tool C-4068 (figure 14-11).

(5) The needle roller bearing in the rectifier end shield is a press fit. If it is necessary to remove the rectifier end frame needle bearing, protect the end shield by supporting the shield with tool C-3925 when pressing the bearing out with tool C-3770-A (figure 14-12).

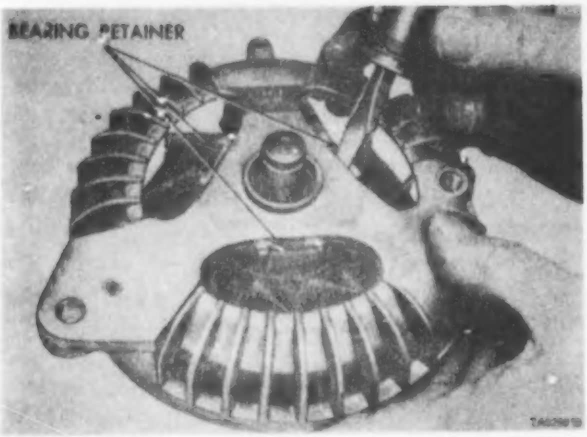

BEARING RETAINER

Figure 14-10. Disengaging Bearing Retainer from End Shield.

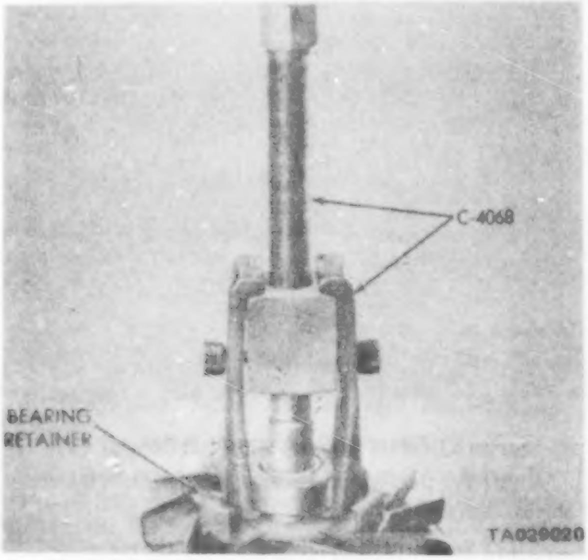

C-4068
BEARING RETAINER
TA029020

Figure 14-11. Removing Bearing from Rotor Shaft.

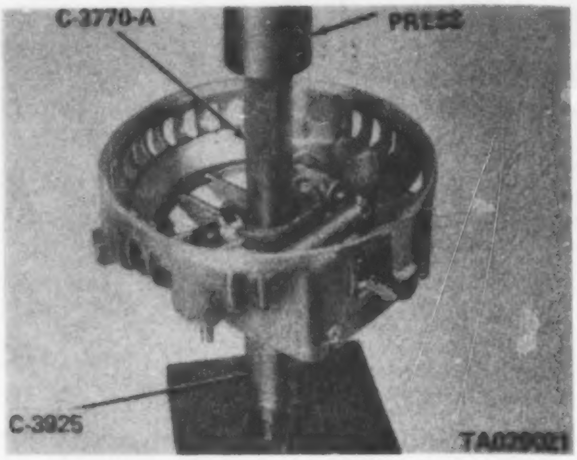

C-3770-A
PRESS
C-3925
TA029021

Figure 14-12. Removing Rectifier End Shield Bearing.

d. Installing the Pulley and Bearing. Instructions for installing the alternator pulley and bearing are included in paragraph 14-5.

14-5. Assembling the Alternator.

a. Position the grease retainer on the rotor shaft and press the retainer on the shaft (figure 14-13). The plastic retainer is properly positioned when the inner bore of the installer tool bottoms on the rotor shaft.

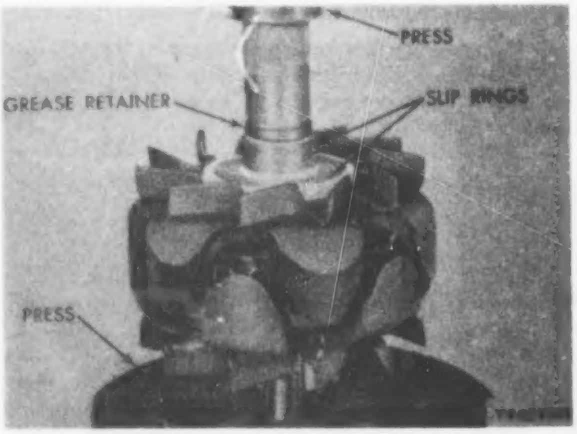

PRESS
GREASE RETAINER
SLIP RINGS
PRESS

Figure 14-13. Installing Grease Retainer.

b. Position the rectifier end shield bearing on the base of tool C-4201. Place the alternator end shield on top of the bearing so that it is properly alined. With the top part of tool C-4201 placed on the end shield, press it into place until it bottoms against the alternator (figure 14-14). New bearings are prelubricated; additional lubrication is not required.

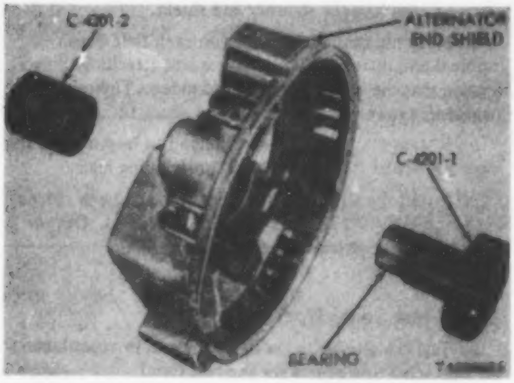

C-4201-2
ALTERNATOR END SHIELD
C-4201-1
BEARING

Figure 14-14. Installing Rectifier End Shield Bearing.

c. Insert the drive end bearing in the drive end shield and install the bearing retainer plate to hold the bearing in place.

d. Position the bearing and drive end shield on the rotor shaft and, while supporting the base of the rotor shaft, press the bearing end shield into position on the rotor shaft with an arbor press and tool C-3858 (figure 14-15).

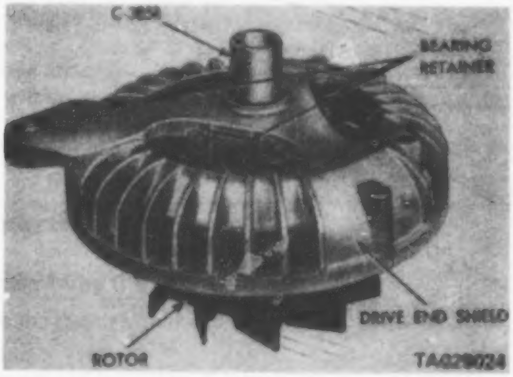

C-3858
BEARING RETAINER
DRIVE END SHIELD
ROTOR
TA029024

Figure 14-15. Installing Drive End Shield Bearing.

e. Install the pulley on the rotor shaft. The shaft of the rotor must be supported in a manner so all pressing force is on the pulley hub and rotor shaft (figure 14-16). Press the pulley on the rotor shaft until the pulley contacts the inner cup of the drive and bearing.

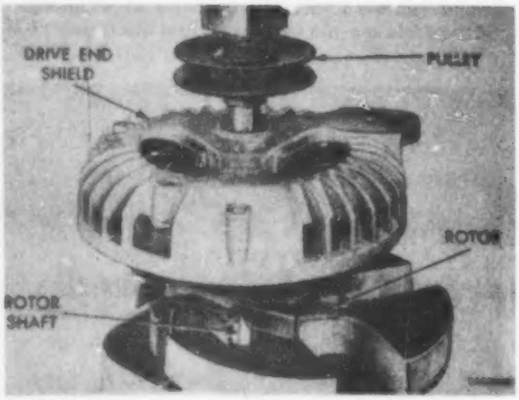

DRIVE END SHIELD
PULLEY
ROTOR
ROTOR SHAFT

Figure 14-16. Installing Pulley.

f. If removed, install the output terminal stud and the insulator through the end shield. Be sure the mica insulators are in place and undamaged (figure 14-17).

g. Install the positive heat sink assembly over the studs; guide the rectifier straps over the studs on the terminal block.

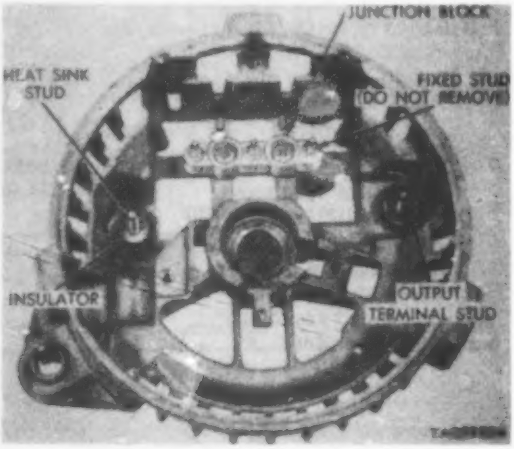

JUNCTION BLOCK
HEAT SINK STUD
FIXED STUD (DO NOT REMOVE)
INSULATOR
OUTPUT TERMINAL STUD

Figure 14-17. Output Terminal Stud and Insulators Installed.

h. Install the capacitor terminal over the capacitor end stud. Install the capacitor shoulder insulator. Ground the capacitor bracket to the end shield with a metal screw. Install and tighten the positive heat sink nut and the lockwasher assemblies

i. Slide the negative rectifier and the heat sink assembly into place in the end shield. Position the straps on the terminal junction block studs. Install the screws through the end shield and into the negative heat sink (figure 14-18).

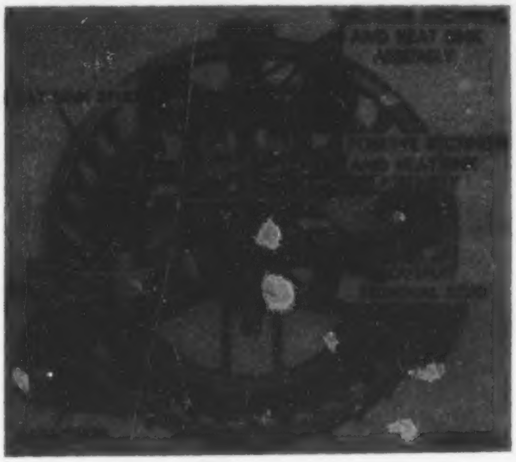

AND HEAT SINK
ASSEMBLY

Figure 14-18. Capacitor and Insulator Installed.

j. Position the stator over the rectifier end shield and install the winding terminals on the terminal block. Press the stator pins into the end shield and install and tighten the winding terminal nuts. Route the leads so that they cannot contact the rotor or the sharp edge of the negative heat sink.

k. Position the rotor and the drive end shield assembly over the stator and the rectifier end shield assembly. Aline the bolt holes in the stator, rectifier plate, and drive end shields.

l. Compress the stator and both end shields manually and install the bolts and washers. Tighten the bolts evenly.

m. Install the field brushes in the insulated holders. Position the vertical and horizontal field brushes in the proper location in the rectifier end shield.

n. Place the insulating washer on each field brush terminal and install the lockwashers and attaching screws. Be sure that the brushes are not grounded. Tighten the attaching screws.

o. Rotate the pulley slowly by hand to be sure that the rotor fan blades do not hit the stator winding leads.

p. Install the alternator on a test stand. Check current output (see TM 9-2320-266-20 for procedures). Output current must be at least 47 amps.

14-6. Test Stand Operation.

a. Test the alternator on the test stand in accordance with the operating procedures for the test stand.

b. To mount the alternator on the test stand, it will be necessary to make an adapter. Instructions for making the adapter are shown in figure 14-19.

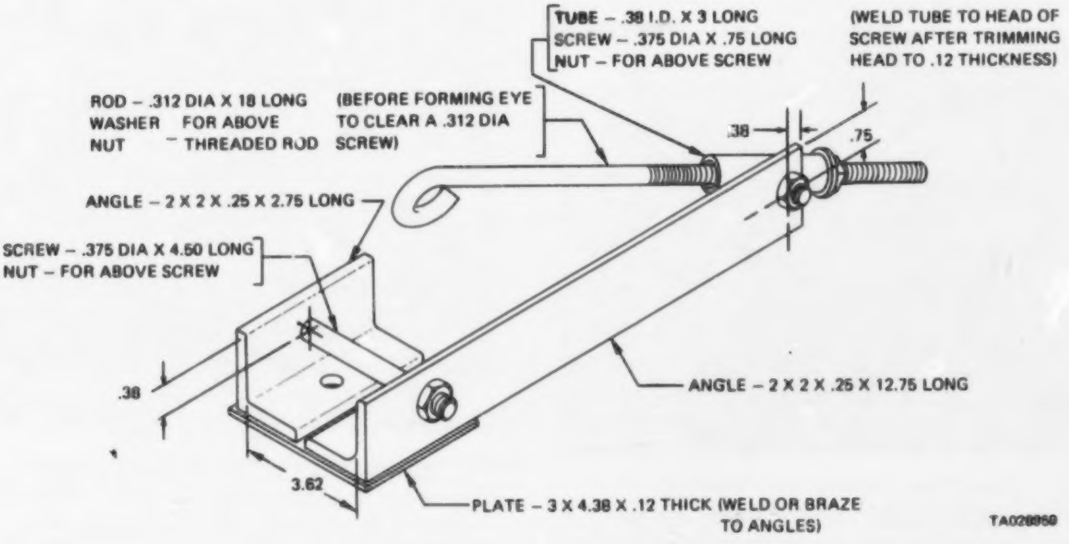

TUBE – .38 I.D. X 3 LONG
SCREW – .375 DIA X .75 LONG
NUT – FOR ABOVE SCREW
(WELD TUBE TO HEAD OF SCREW AFTER TRIMMING HEAD TO .12 THICKNESS)
ROD – .312 DIA X 18 LONG
WASHER FOR ABOVE
NUT – THREADED ROD
(BEFORE FORMING EYE TO CLEAR A .312 DIA SCREW)
.38
.75
ANGLE – 2 X 2 X .25 X 2.75 LONG
SCREW – .375 DIA X 4.50 LONG
NUT – FOR ABOVE SCREW
.38
ANGLE – 2 X 2 X .25 X 12.75 LONG
3.62
PLATE – 3 X 4.38 X .12 THICK (WELD OR BRAZE TO ANGLES)
TA028859

Figure 14-19. Test Stand Mounting Adapter.

CHAPTER 15

REPAIR OF THE STARTER

15-1. Starter Specifications.

Starter motor specifications are included in table 15-1.

Table 15-1. Starting Motor Specifications

Starting motor model	3755900
Make	Chrysler built
Voltage	12
Number of fields	4 series parallel
Number of poles	4
Brushes	4
Spring tension	32 to 36 ounces
Drive	Solenoid shift overrunning clutch
End play	0.010 - 0.045 in
Cranking amperage draw (on vehicle)	180 amps max.* (200 amps when cold)
Free running test	
Voltage	11
Amperage draw	90
Minimum speed	3,700 rpm
Locked resistance test	
Voltage	4
Amperage draw	475 to 550
Solenoid switch	
Pull-in coil	13 to 15 amps @ 6V @ 77° F
Hold-in coil	8 to 9 amps @ 6V @ 77° F

*At operating temperature

15-2. Disassembling the Starter.

a. Remove the through bolts and the end head assembly (figure 15-1).

b. Remove the armature from the gear housing and field-frame assembly (figure 15-2).

c. Pull the field-frame assembly from the gear housing far enough to expose the terminal screw. Remove the terminal screw (figure 15-3).

d. Remove the field-frame assembly.

e. Remove the nut, steel washer, and insulated washer from the solenoid terminal (figure 15-4).

f. Unwind the solenoid lead wire from the brush terminal to disconnect it (figure 15-5).

g. Remove the nuts attaching the solenoid and brush-holder plate assembly to the gear housing (figure 15-6).

h. Remove the solenoid and brush plate assembly from the gear housing (figure 15-7).

i. Remove the screws attaching the solenoid to the brush plate (figure 15-8).

j. Remove the solenoid and the battery supply cable nut from the brush plate (figures 15-9 and 15-10).

k. Remove the solenoid contact and plunger assembly from the solenoid (figure 15-11).

l. Remove the return spring from the inside of the solenoid moving core (figure 15-12).

m. Remove the dust cover from the gear housing (figure 15-13).

n. Remove the driven-gear snap ring (figure 15-14).

o. Remove the pinion-shaft retainer clip (figure 15-15).

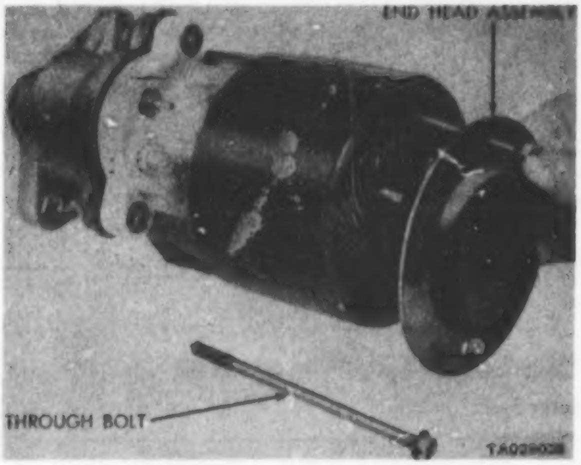

END HEAD ASSEMBLY
THROUGH BOLT
TA029028

Figure 15-1. Removing Through Bolts and End Head Plate.

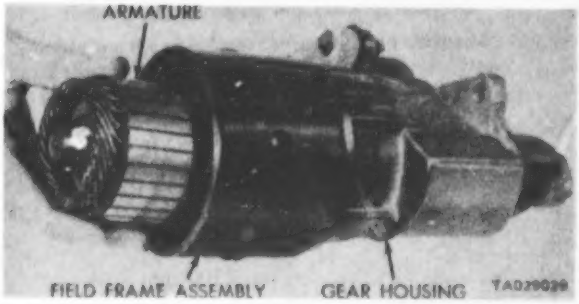

ARMATURE
FIELD FRAME ASSEMBLY
GEAR HOUSING
TA029029

Figure 15-2. Removing Armature.

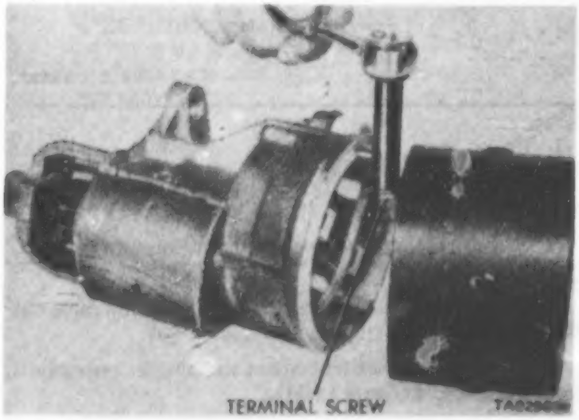

TERMINAL SCREW
TA029030

Figure 15-3. Removing Terminal Screw.

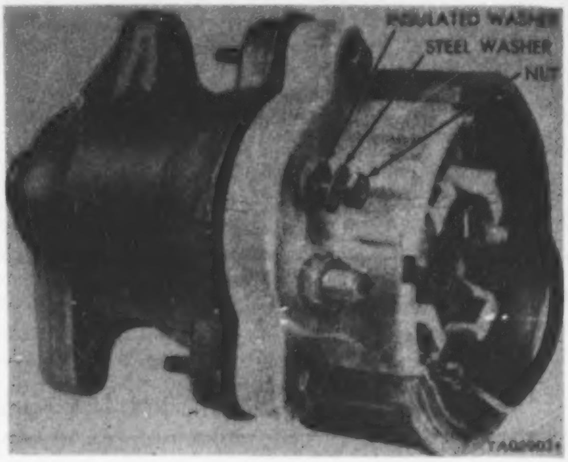

INSULATED WASHER
STEEL WASHER
NUT
TA029031

Figure 15-4. Removing Nuts and Washers from Solenoid Terminal.

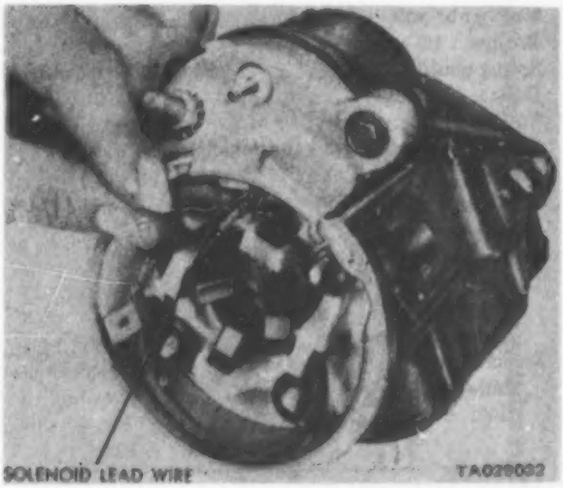

SOLENOID LEAD WIRE
TA029032

Figure 15-5. Unwinding Solenoid Lead Wire.

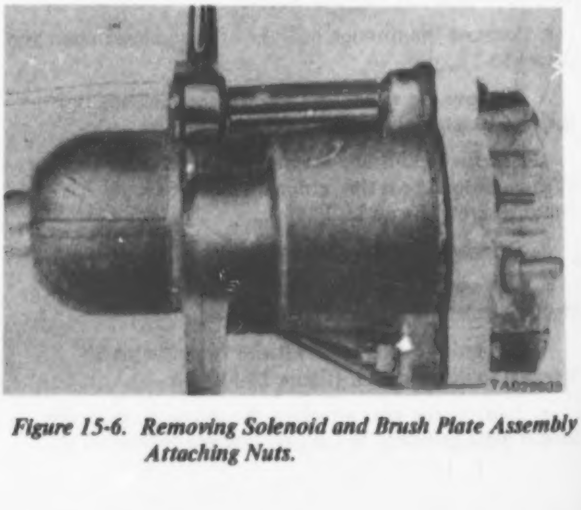


Figure 15-6. Removing Solenoid and Brush Plate Assembly Attaching Nuts.

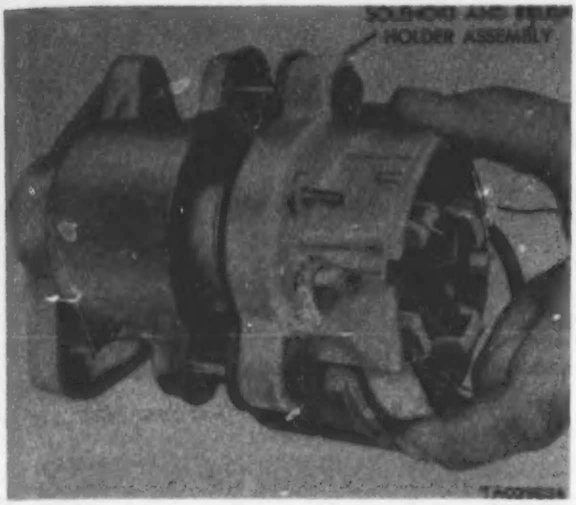

SOLENOID AND BRUSH
HOLDER ASSEMBLY

Figure 15-7. Removing Solenoid and Brush Plate Assembly.

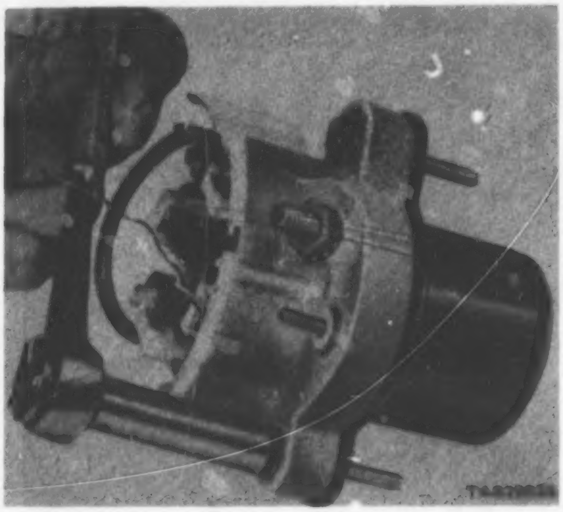


Figure 15-8. Removing Solenoid Attaching Screws.

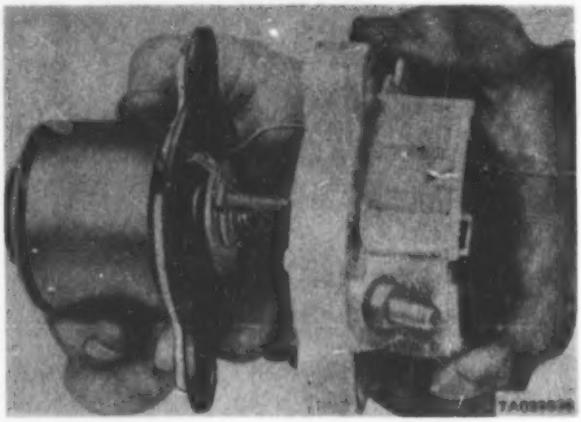


Figure 15-9. Removing Solenoid.

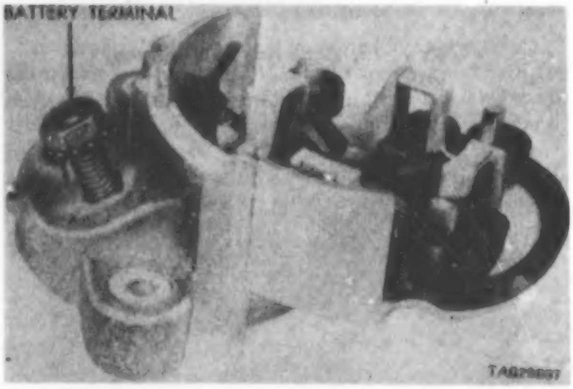

BATTERY TERMINAL

Figure 15-10. Removing Battery Terminal Nut and Washer.

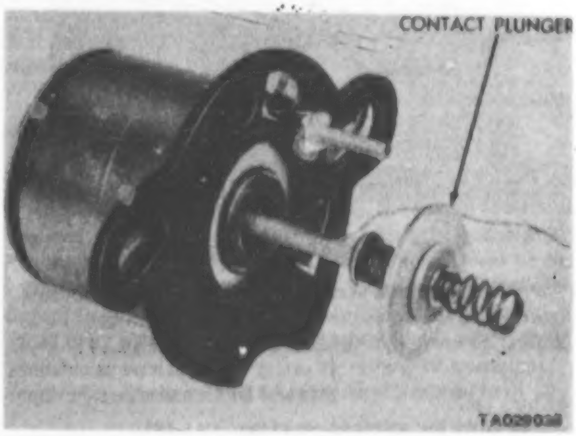

CONTACT PLUNGER

Figure 15-11. Removing Contact and Plunger.

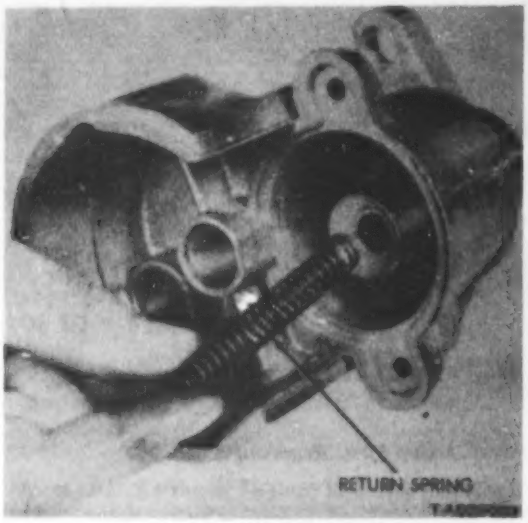

RETURN SPRING

Figure 15-12. Removing Return Spring.

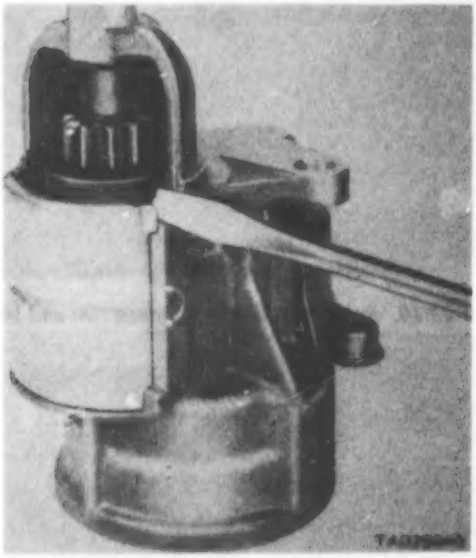


Figure 15-13. Removing Dust Cover.

p. Push the pinion shaft toward the rear of the housing figure 15-16). Remove the retainer ring and thrust washers. Remove the clutch assembly (figure 15-17).

q. Remove the driven gear and friction washer.

r. Remove the solenoid core (figure 15-18).

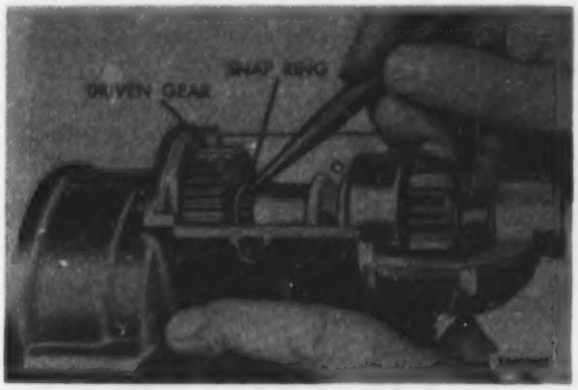

DRIVEN GEAR
SNAP RING

Figure 15-14. Removing Driven-Gear Snap Ring.

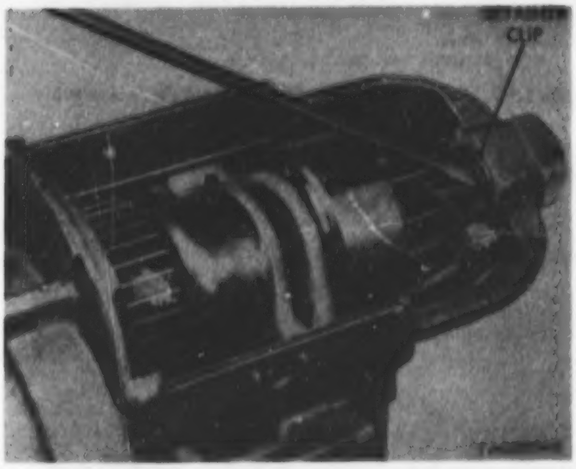

RETAINER CLIP

Figure 15-15. Removing Pinion-Shaft Retainer Clip.

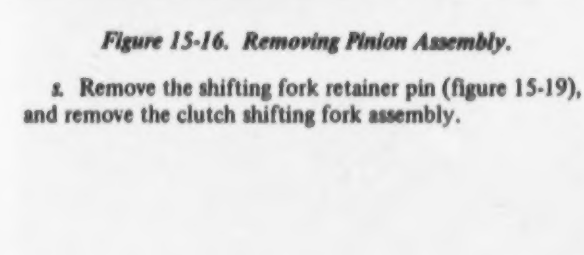

PINION SHAFT
THRUST WASHER

Figure 15-16. Removing Pinion Assembly.

s. Remove the shifting fork retainer pin (figure 15-19), and remove the clutch shifting fork assembly.

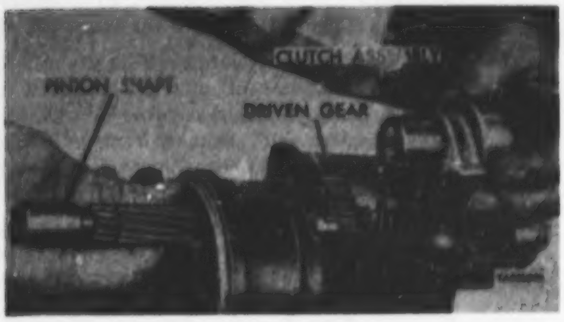


Figure 15-17. Removing Clutch Assembly.

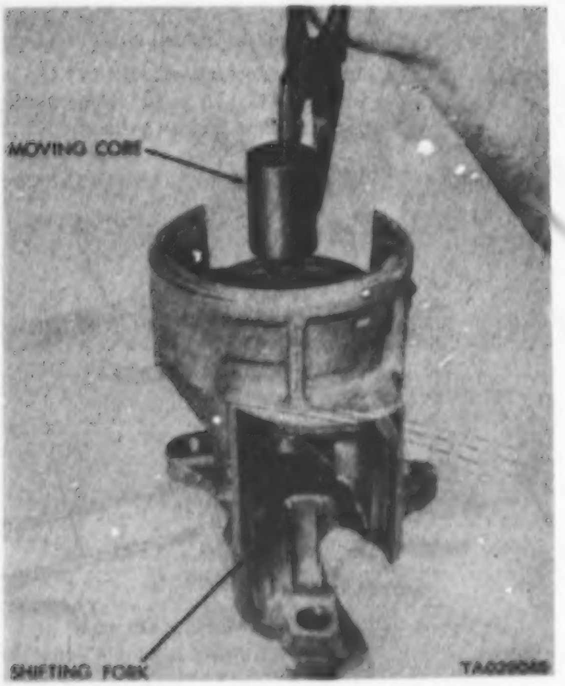


Figure 15-18. Removing Solenoid Cord.

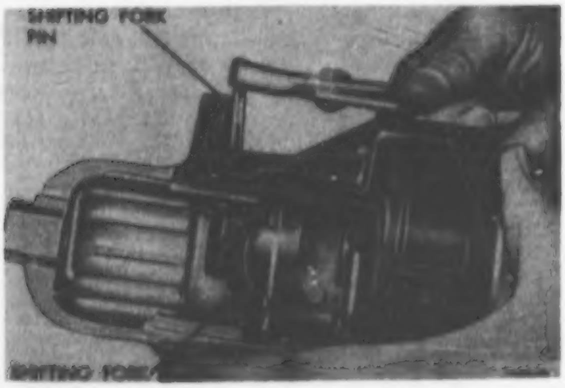


Figure 15-19. Removing Shifting Fork Pin.

15-3. Cleaning the Starter Parts.

CAUTION

Do not immerse starter parts in solvent.

The starter-clutch outer housing, brush plate, and pinion gear may be cleaned with a cloth moistened with cleaning solvent. Wipe dry with a clean, dry cloth. Clean the terminal contacts and the contactor with crocus cloth.

15-4. Testing the Armature.

a. Testing for Short Circuit. Place the armature in a growler, and slowly rotate it while holding a thin steel blade above and parallel to the core. A shorted armature will cause the blade to vibrate and be attracted to the core. Replace the armature if it is shorted.

b. Testing for Ground. Connect a pair of test lamp probes to each of the commutator riser bars and the armature shaft. If the lamp lights up, the armature is grounded. Replace a grounded armature.

c. Testing Commutator Runout and Refacing. Place the armature in a pair of "V" blocks and measure both the shaft and the commutator for runout using a dial indicator. A bent shaft means the armature must be replaced. When commutator runout exceeds 0.004 inch, remove enough metal to provide a smooth, even surface. Clean the commutator grooves and retest (*a* and *b*, above).

15-5. Testing the Field Coils for Ground.

a. Remove the field frame assembly from the starter.

b. Drill out the rivet attaching the field coil ground leads to the field frame.

c. Insulate the field coil leads from the field frame.

d. Test for ground using the growler test lamp. Touch one probe of the test lamp to the field coil lead and the other probe to the field frame. The lamp should not light. If it does, the field coils are grounded and require replacement.

e. The field coils are replaced as part of the field-frame assembly.

15-6. Servicing the Starter Bushings.

Inspect the armature shaft bearing, the pinion shaft surfaces, and the bushings for wear. Insert the bushings in the shafts and test for side play. This indicates wear on the bushings. Remove and replace any worn out bushings using appropriate adapters. The end head and bushing are serviced as an assembly. Pre-sized starting motor bushings are available as service bushings; no burnishing or reaming is required to fit them. Use a brass drift to install.

15-7. Servicing the Clutch Unit.

Rotate the pinion. The pinion gear should rotate smoothly in one direction, but should not rotate in the opposite direction. If the starter clutch unit does not function properly, or the pinion is worn, chipped, or burred, replace the starter clutch unit.

15-8. Assembling the Starter.

a. General. Refer to figure 15-20.

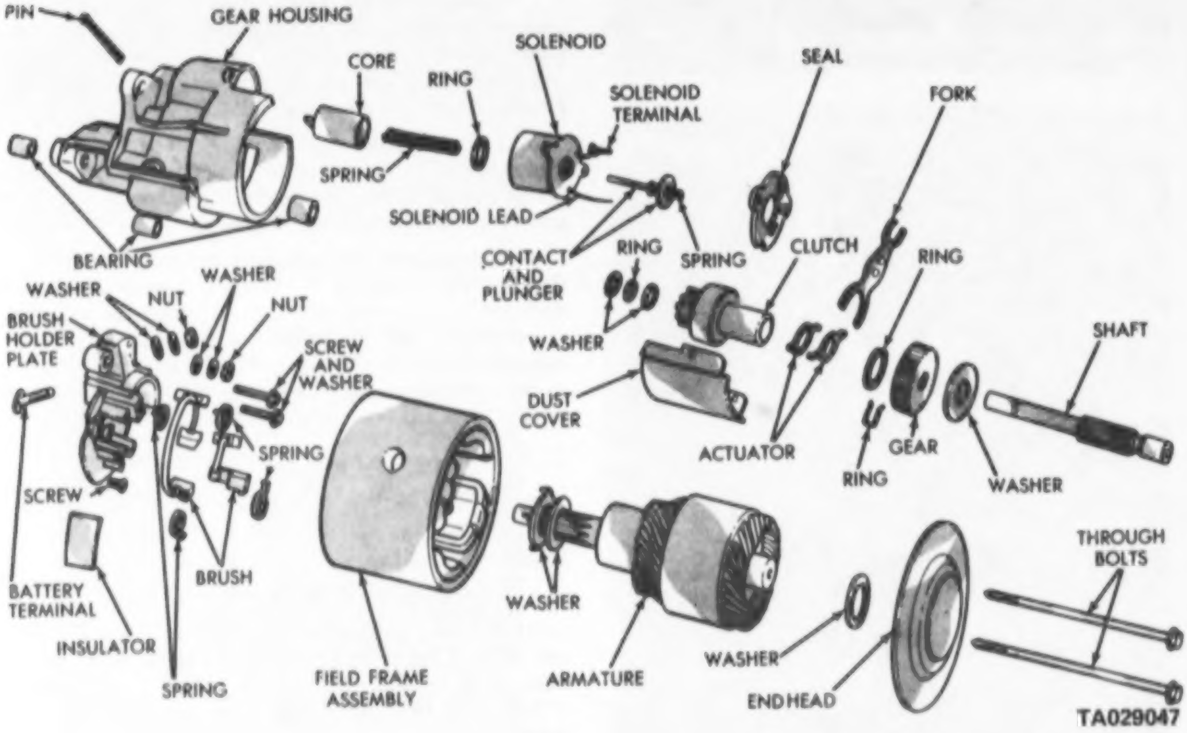

PIN
GEAR HOUSING
CORE
RING
SOLENOID
SEAL
SOLENOID TERMINAL
FORK
SPRING
SOLENOID LEAD
BEARING
CONTACT AND PLUNGER
RING
SPRING
CLUTCH
RING
WASHER
NUT
WASHER
NUT
BRUSH HOLDER PLATE
SCREW AND WASHER
WASHER
SHAFT
DUST COVER
SPRING
ACTUATOR
GEAR
RING
WASHER
SCREW
THROUGH BOLTS
BRUSH
WASHER
BATTERY TERMINAL
INSULATOR
WASHER
SPRING
FIELD FRAME ASSEMBLY
ARMATURE
ENDHEAD
TA029047

Figure 15-20. Starter.

b. Procedure.

(1) Position the shifter fork in the drive housing and install the shifting fork retainer pin (figure 15-21). One tip of the pin should angle away from the housing. The fork and retainer pin should operate freely after bending the tip of the pin.

(2) Install the solenoid moving core and engage the shifting fork (figure 15-18).

(3) Put the pinion shaft into the drive housing and install a friction washer and the drive gear.

(4) Install the clutch and pinion assembly, and the retaining and thrust washers (figure 15-17).

(5) Complete the installation of the pinion shaft engaging the shifting fork with the clutch actuators. The friction washer must be positioned on the shoulder of the splines of the pinion shaft before the driven gear is positioned.

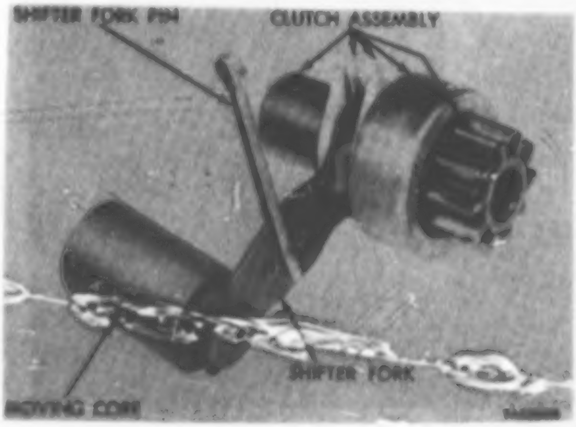

SHIFTER FORK PIN
CLUTCH ASSEMBLY
SHIFTER FORK
MOVING CORE

Figure 15-21. Shifter Fork and Clutch Arrangement.

(6) Install the driven-gear snap ring (figure 15-14).

(7) Install the pinion-shaft retainer clip (figure 15-15).

(8) Put the starter-solenoid return spring into the bore of the movable core. Inspect the condition of the starter solenoid switch contacting washer. If the top of the washer is burned from arcing, disassemble the contact switch plunger assembly and reverse the washer.

(9) Install the solenoid contact plunger assembly into the solenoid. Make sure the contact spring is positioned on the shaft of the solenoid contact plunger assembly.

(10) Assemble the battery terminal stud in the brush holder. Inspect the condition of the contacts in the brush-holder plate. If they are burned, replace the brush holder with brushes and contacts as an assembly.

(11) Position the seal on the brush-holder plate.

(12) Put the solenoid lead wire through the hole in the brush holder (figure 15-22) and install the solenoid stud, the insulating washer, and the washer and nut.

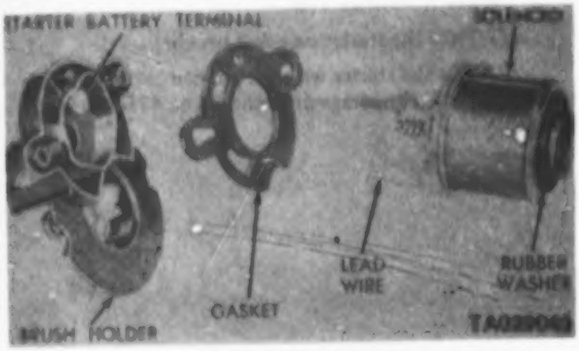


Figure 15-22. Assembling Solenoid to Brush Holder Assembly.

(13) Wrap the solenoid lead wire tightly around the brush terminal post as shown in figure 15-23 and solder it securely with a high temperature resin core solder and resin flux.

(14) Attach the brush holder to the solenoid attaching screws.

(15) Place the solenoid coil and the brush-plate assembly into the bore of the gear housing. Place the brush-plate assembly in the starter gear housing (figure 15-24). Install the housing attaching nuts and tighten.

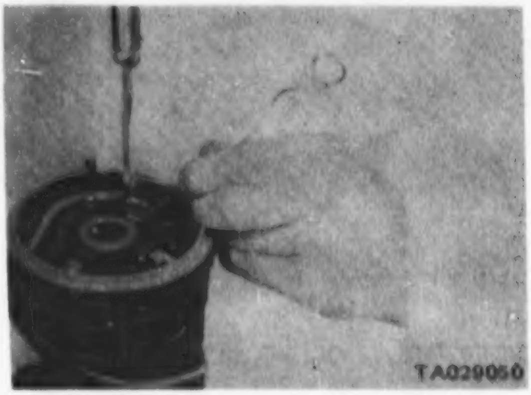


Figure 15-23. Soldering Solenoid Lead to Brush Terminal.

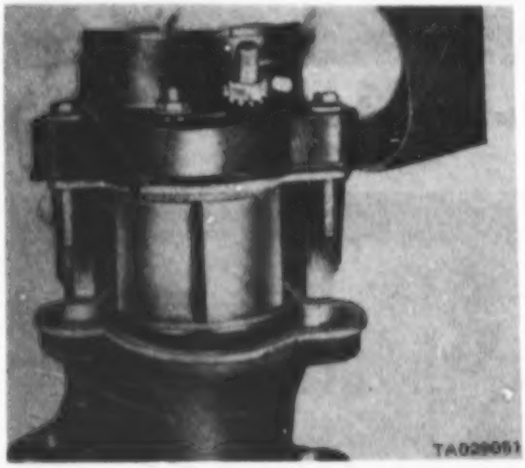


Figure 15-24. Installing Solenoid and Brush Plate Assembly.

(16) Position the brushes with the armature thrust washer as shown in figure 15-25. This will hold the brushes out and facilitate proper installation of the armature.

(17) Install the brush terminal screw (figure 15-3).

(18) Position the field frame to the exact position on the gear housing and put the armature into the field frame and starter gear housing (figure 15-26). Rotate the armature slightly to engage the splines of the shaft with the reduction gear.

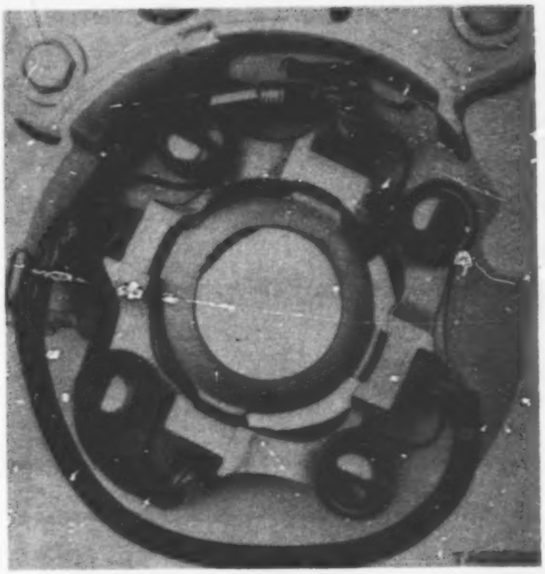


Figure 15-25. Positioning Armature Thrust Washer to Brushes.

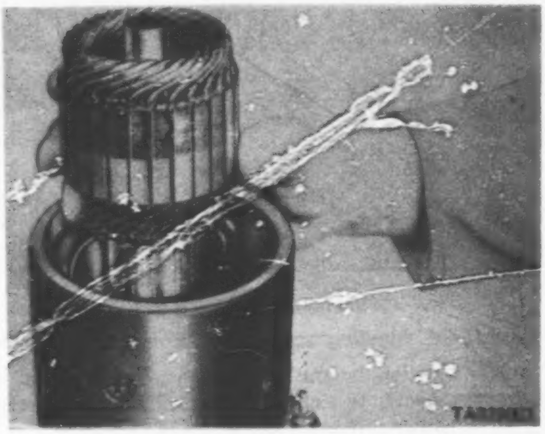


Figure 15-26. Installing Armature.

(19) Install the thrust washer on the armature shaft.

(20) Position the starter end head assembly. Install the through bolts and tighten.

15-9. Testing the Starter.

a. Free Running Test. Place the starter in a vise and connect a fully-charged, 12V battery to it as follows:

(1) Connect a test ammeter (100 amp scale) and a carbon pile rheostat in the series with the battery positive post and the starter terminal.

(2) Connect a voltmeter (15V scale) across the starter.

(3) Rotate the carbon pile to maximum resistance.

(4) Connect the battery cable from the battery negative post to the starter frame.

(5) Adjust the rheostat until the battery voltage shown on the voltmeter reads 11V. Amperage draw should be 90 amps (see table 15-1).

b. Locked Resistance Test.

(1) Place the starter on a test bench.

(2) Test the starter with the applied battery voltage adjusted to 4V. Amperage draw should be 475-550 amps (see table 15-1).

CHAPTER 16

REPAIR OF THE RADIATOR AND HEATER CORE

16-1. Replacing the Heater Core and Radiator.

Instructions for replacing the heater core and radiator are contained in TM 9-2320-266-20.

16-2. Heater Core and Radiator Repair.

Heater core and radiator repairs must be accomplished using the procedures outlined in TM 750-254.

CHAPTER 17

REPAIR OF THE TRANSFER CASE ASSEMBLY

17-1. Disassembling, Cleaning, and Inspecting the Transfer Assembly.

a. Disassembly.

(1) Position the drained transfer case on a suitable work table (figure 17-1), and remove the speedometer drive gear adapter.

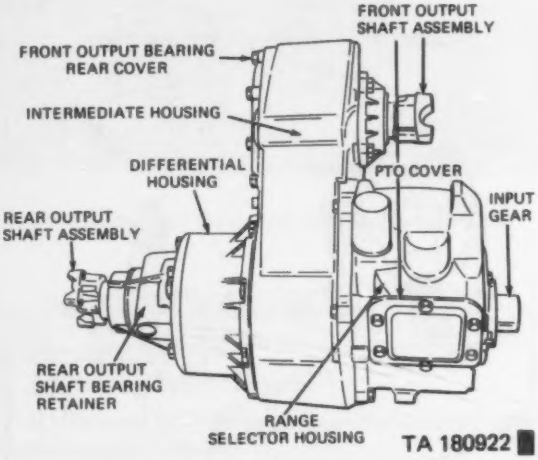

FRONT OUTPUT SHAFT ASSEMBLY
FRONT OUTPUT BEARING REAR COVER
INTERMEDIATE HOUSING
DIFFERENTIAL HOUSING
PTO COVER
INPUT GEAR
REAR OUTPUT SHAFT ASSEMBLY
REAR OUTPUT SHAFT BEARING RETAINER
RANGE SELECTOR HOUSING
TA 180922

Figure 17-1. Transfer Case in Position for Removing Output Yokes.

(2) Using holding tool C-3281 and a 1-5/16 inch socket with a suitable handle, loosen the rear output shaft yoke nut

(3) Using holding tool C-3281 and a socket with a suitable handle, remove the front output shaft yoke nut (figure 17-2). Remove the washer and yoke.

(4) Remove the front output shaft bearing retainer bolts (figure 17-3). Remove the retainer. Discard the gasket.

(5) Using a jack or other suitable lifting device, position the transfer case on blocks (figure 17-4)

(6) Remove the differential housing retainer bolts and disengage the assembly from the transfer case. Remove and discard all gaskets.

(7) Slide the carrier unit from the shaft. A 1-1/2 to 2 inch band-type hose clamp may be installed on the input shaft to prevent losing the bearings when removing the input shaft assembly from the range box

(8) Raise the shift rail, and drive the retaining pin out of the shift fork (figure 17-5).

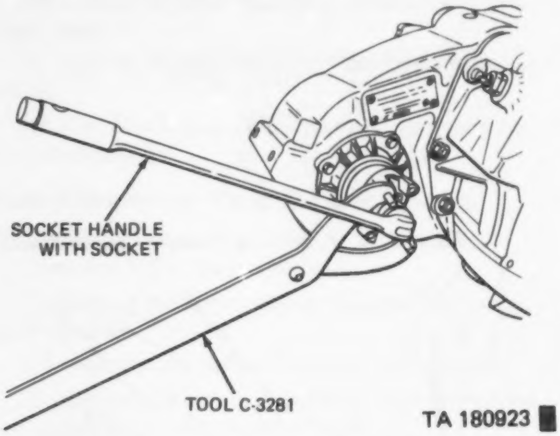

SOCKET HANDLE WITH SOCKET
TOOL C-3281
TA 180923

Figure 17-2. Loosening Front Output Shaft Yoke Nut.

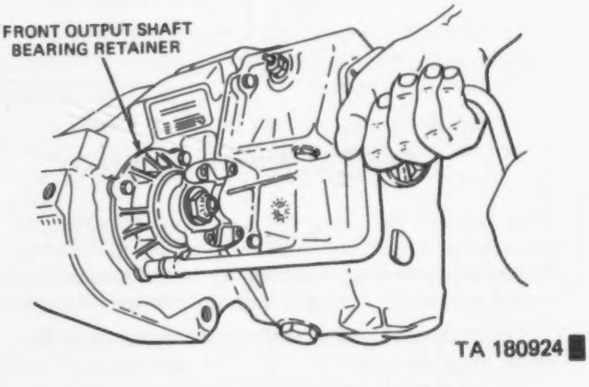

FRONT OUTPUT SHAFT BEARING RETAINER
TA 180924

Figure 17-3. Removing Bearing Retainer Screws.

(9) Remove the shift rail detent ball plug, gasket, spring, and ball from the case (figure 17-6) A small magnet may be used to remove the ball.

(10) Push the shift rail down, and lift it up on the lockout clutch. Remove the shift fork from the clutch assembly.

(11) **Remove the front output shaft rear bearing retainer bolts. Tap on the front of the shaft or carefully pry the retainer away from the case. Remove the retainer from the shaft and discard the gasket. Recover any roller bearings**

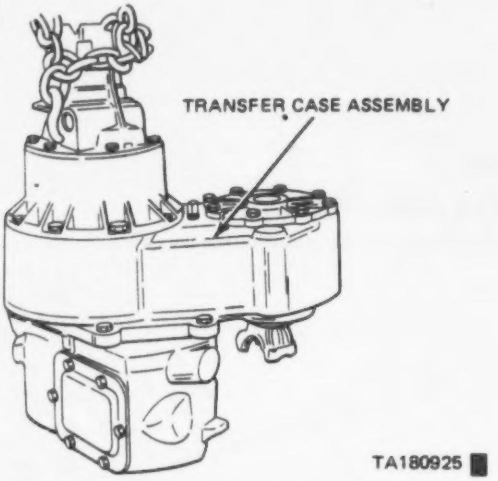


Figure 17-4. Positioning Transfer Case on Blocks.

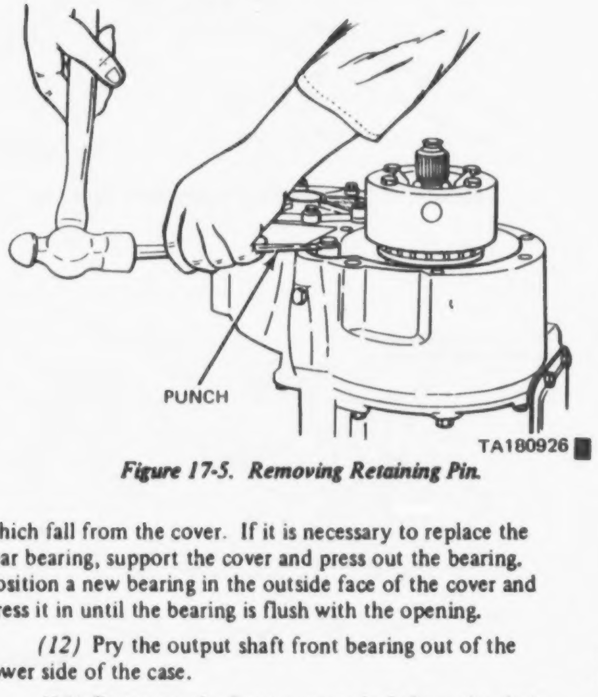


Figure 17-5. Removing Retaining Pin.

which fall from the cover. If it is necessary to replace the rear bearing, support the cover and press out the bearing. Position a new bearing in the outside face of the cover and press it in until the bearing is flush with the opening.

(12) Pry the output shaft front bearing out of the lower side of the case.

(13) Disengage the front output shaft from the chain and remove the shaft from the case (figure 17-7).

(14) Remove the bolts attaching the intermediate chain housing to the range box. Using a chain hoist, remove the intermediate housing from the range box (figure 17-8).

(15) Remove the chain from the intermediate housing.

(16) Remove the lockout clutch, drive gear, and input shaft assembly from the range box. A 1-1/2 to 2 inch band-type hose clamp may be used to retain the 123 roller bearings on the input shaft.

(17) Pull up the shift rail and disconnect it from the link.

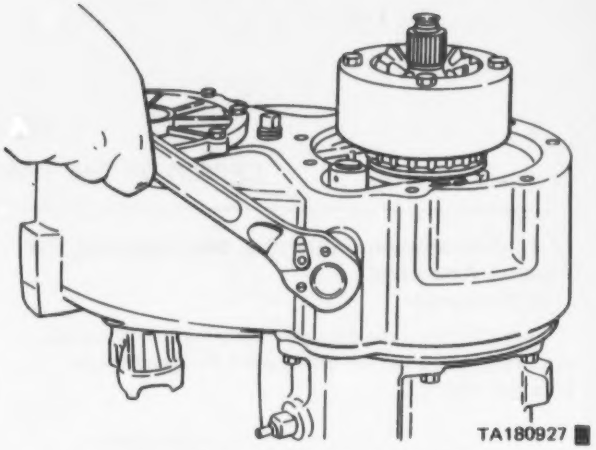


Figure 17-6. Removing Detent Ball Plug.

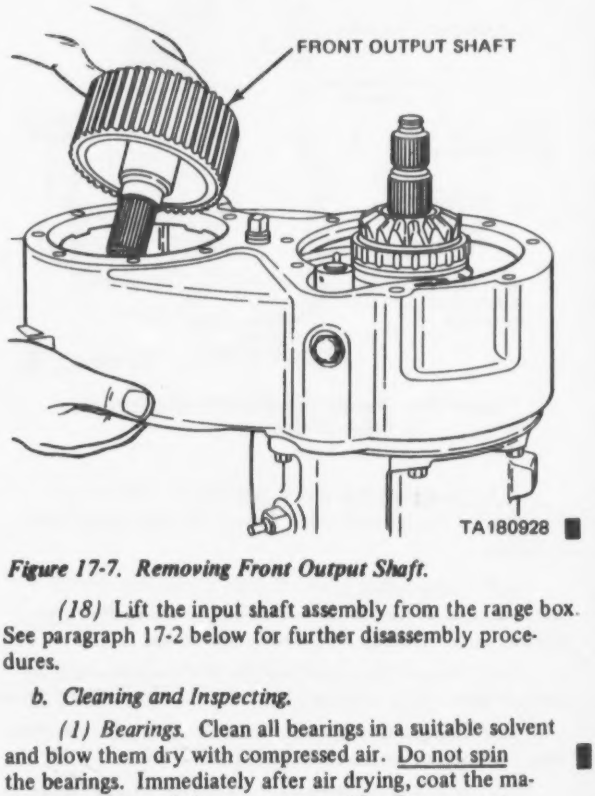


Figure 17-7. Removing Front Output Shaft.

(18) Lift the input shaft assembly from the range box. See paragraph 17-2 below for further disassembly procedures.

b. Cleaning and Inspecting.

(1) Bearings. Clean all bearings in a suitable solvent and blow them dry with compressed air. Do not spin the bearings. Immediately after air drying, coat the machined surfaces of all components with oil to prevent corrosion.

(2) Shafts and gears. With a suitable solvent, clean all shafts and gears of all deposits. Dry with compressed air.

(3) Case, cover, and housings. Clean the transfer case, cover, and housings thoroughly, removing all dirt and lubricant. Remove residual deposits from the magnets in the range box and chain housing. Remove all gasket material from the gasket surface areas.

(4) Inspection. Carefully inspect all bearings and rollers for wear or damage. Use new parts if replacement is necessary. Inspect the shaft splines, drive chain, and gears. Replace any parts showing wear or damage with new parts.

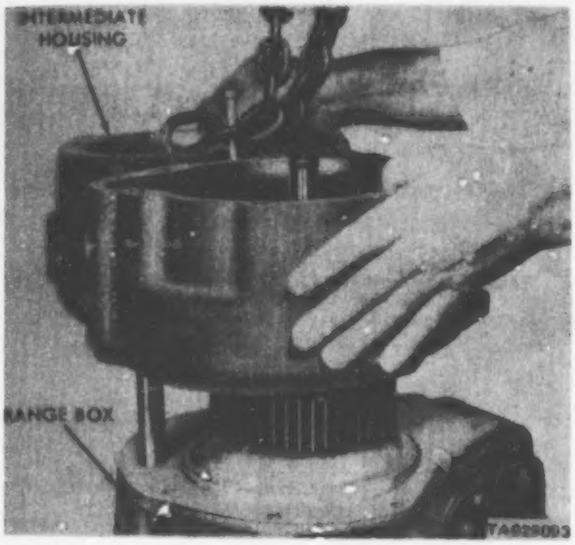


Figure 17-8. Removing Intermediate Housing.

17-2. Disassembly of Subassemblies.

Refer to figure 17-9.

a. Differential Carrier Assembly.

(1) Remove the bolts from the carrier assembly and separate the carrier section.

(2) Lift the pinion gear and spider assembly from the carrier. See that the undercut side of the pinion gear spider faces toward the front side gear.

(3) Remove the pinion thrust washers, the pinion roller washers, and the pinion gears and roller bearing from the spider unit.

(4) Clean and inspect all components. Replace all worn or damaged parts.

b. Lockout Clutch Assembly.

(1) Remove the front side gear from the input shaft assembly. Remove the thrust washer, roller bearings (123), and spacers from the front side gear bore. Note the position of the spacers to facilitate reassembly.

(2) Using the snap ring pliers, remove the drive sprocket-to-clutch assembly retaining ring. Slide the drive sprocket from the front side gear.

(3) Remove the lower snap ring.

(4) Remove the sliding gear, spring, and spring cup washer from the front side gear.

(5) Clean and inspect all components. Replace all worn or defective parts.

c. Input Shaft Assembly.

(1) Slide the thrust washer and spacer from the shaft.

(2) Using the snap ring pliers, remove the retainer from the input shaft (figure 17-10).

(3) Tap the shaft out of low-speed gear. Look for the two thrust-washer pins in the shaft.

(4) With a screwdriver, remove the lockring out of the bearing retainer (figure 17-11). Tap the bearing out of the retainer bore.

(5) Remove the roller bearings (15) from the end of the input shaft.

(6) Remove and discard the "O" ring from the end of the shaft.

(7) Clean and inspect all components. Replace them if worn or damaged.

17-3. Disassembly of Range Selector Housing (Range Box).

a. Removing Shifter Shaft Assembly.

(1) Remove the detent plate spring, plug, and gasket. Discard the gasket.

(2) Disengage the sliding clutch gear from the case.

(3) Remove the shift lever assembly retaining nut and the range shift lever from the shifter shaft.

(4) Remove the shift lever snap ring and locknut shift lever.

(5) Push the shifter shaft assembly down and remove the lockout clutch connector link. The long end of the connector link engages the detent plate.

(6) Remove the shifter shaft assembly from the case and separate the inner and outer shifter shafts. Remove and discard the "O" rings.

(7) Inspect the detent plate for damage. If it is necessary to remove it, drive the pivot shaft from the case. Remove the detent plate and spring from the bottom of the case.

b. Removing Input Gear Assembly.

(1) Remove the input gear bearing retainer and seal assembly. Discard the gasket.

(2) Remove the snap ring from the outer diameter of the input gear bearing.

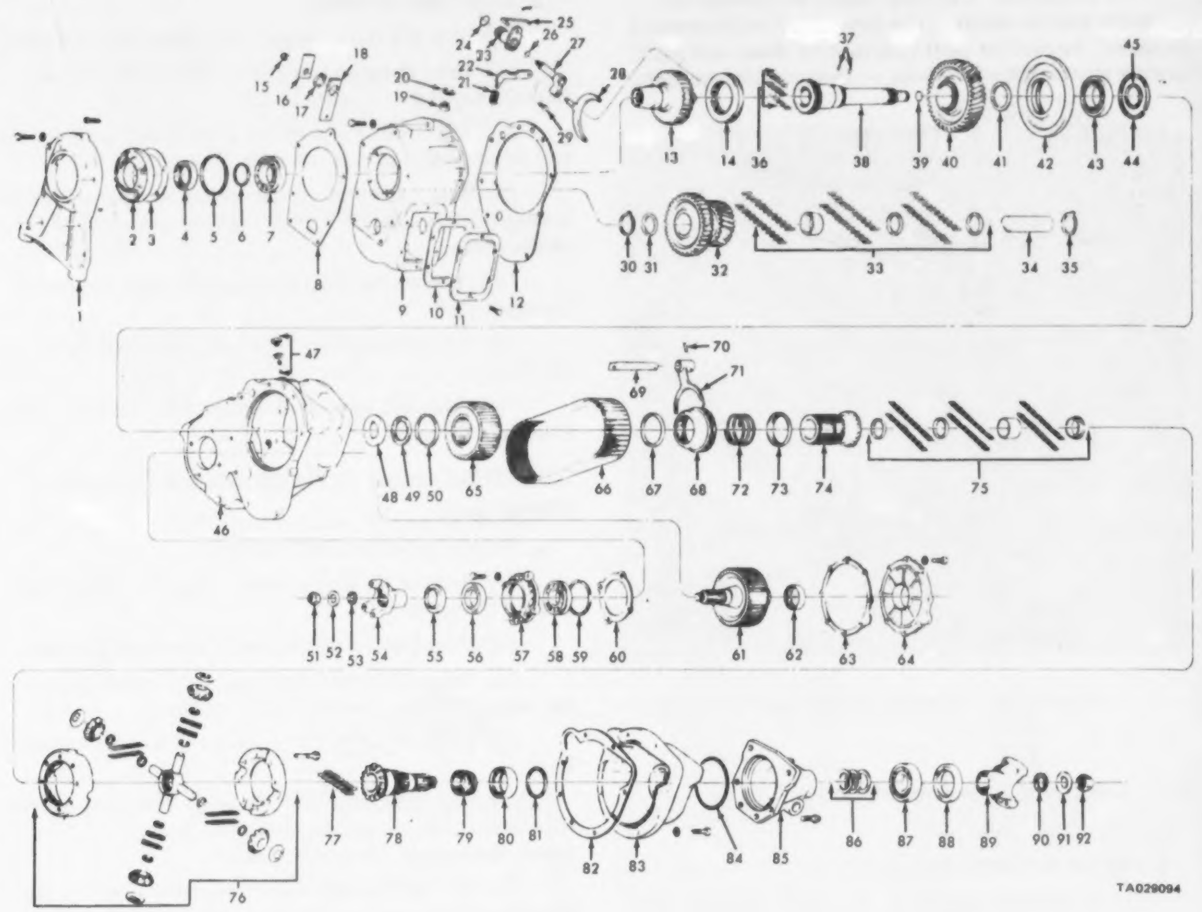
(3) Tap the input gear and bearing from the case.

(4) Remove the bearing retaining snap ring from the input shaft. This is a select fit snap ring. Use sizes A, B, C, or D to provide the tightest fit when reassembling.

c. Removing Countershaft Gear Assembly.

(1) From the intermediate case side, remove the countershaft from the countershaft gear and case. Remove the countershaft gear assembly from the case. Recover 72 roller bearings from the gear case and shaft.

(2) Remove the countershaft gear thrust washers from the case.



Legend for Figure 17-9:

1. Adapter
2. Input gear bearing retainer
3. Input gear bearing retainer gasket
4. Input gear bearing retainer seals
5. Bearing outer ring
6. Bearing to shaft retaining ring
7. Input gear bearing
8. Adapter to selector housing gasket
9. Range selector housing (range box)
10. P.T.O. cover gasket
11. P.T.O. cover
12. Selector housing to intermediate housing gasket
13. Main drive input gear
14. Range selector sliding clutch
15. Shift lever locknut
16. Range selector shift lever
17. Shift lever retaining ring
18. Lockout shift lever
19. Detent plate spring plug
20. Detent plate spring plug gasket
21. Detent plate spring
22. Detent plate
23. Lockout shifter shaft
24. "O" ring seal
25. Lockout shaft connector link
26. "O" ring seal
27. Range selector shifter shaft
28. Range selector shift fork
29. Detent plate pivot pin
30. Thrust washer
31. Spacer (short)
32. Range selector counter gear
33. Countergear roller bearings and spacers (72 bearings req'd.)
34. Countergear shaft
35. Thrust washer
36. Input shaft roller bearings (15 req'd.)
37. Thrust washer pins (2 req'd.)
38. Input shaft
39. "O" ring seal
40. Low speed gear and bushing
41. Thrust washer
42. Input shaft bearing retainer
43. Input shaft bearing
44. Input shaft bearing retaining ring (large)
45. Input shaft bearing retaining ring
46. Chain drive housing (intermediate housing)
47. Lockout shift rail (poppet) plug, gasket, spring and ball.
48. Thrust washer
49. Lubricating thrust washer
50. Retaining ring
51. Flange locknut
52. Washer
53. Seal
54. Front output yoke
55. Dust shield
56. Front output shaft bearing retainer seal
57. Front output shaft bearing retainer
58. Front output shaft bearing
59. Bearing outer ring
60. Bearing retainer gasket
61. Front output shaft
62. Front output shaft rear bearing
63. Front output rear bearing retainer cover gasket
64. Front output rear bearing retainer
65. Drive shaft sprocket
66. Drive chain
67. Retaining ring
68. Sliding lock clutch
69. Lockout shift rail
70. Shift fork retaining pin
71. Lockout shift fork
72. Lockout clutch spring
73. Spring washer cup
74. Front side gear
75. Front side gear bearing and spacers (123 bearings req'd.)
76. Differential carriage assembly (132 bearings req'd.)
77. Rear output shaft roller bearings (15 req'd.)
78. Rear output shaft
79. Speedometer drive gear
80. Rear output shaft front roller bearing

81. Oil pump "O" ring seal
82. Differential housing gasket
83. Differential housing
84. "O" ring, differential housing to rear output shaft housing
85. Rear output shaft housing
86. Shim pack
87. Rear output rear bearing
88. Rear output shaft seal
89. Rear output yoke
90. Rear output shaft rubber seal
91. Washer
92. Flange nut

Figure 17-9. Transfer Assembly.

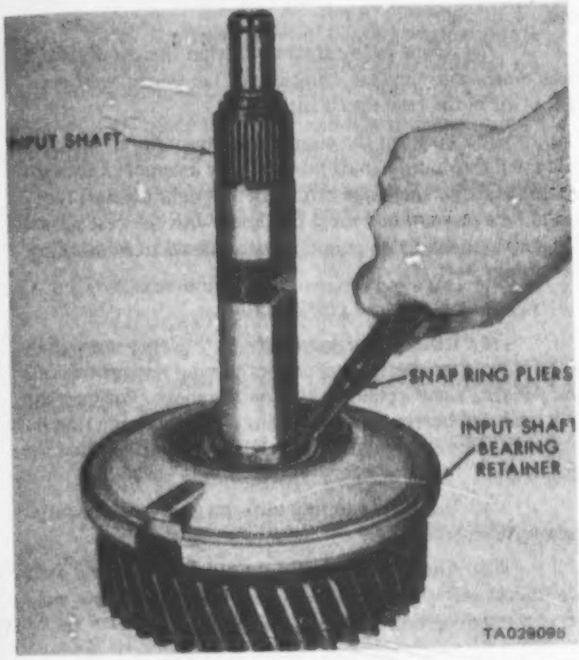


Figure 17-10. Removing Input Shaft Bearing Retainer.

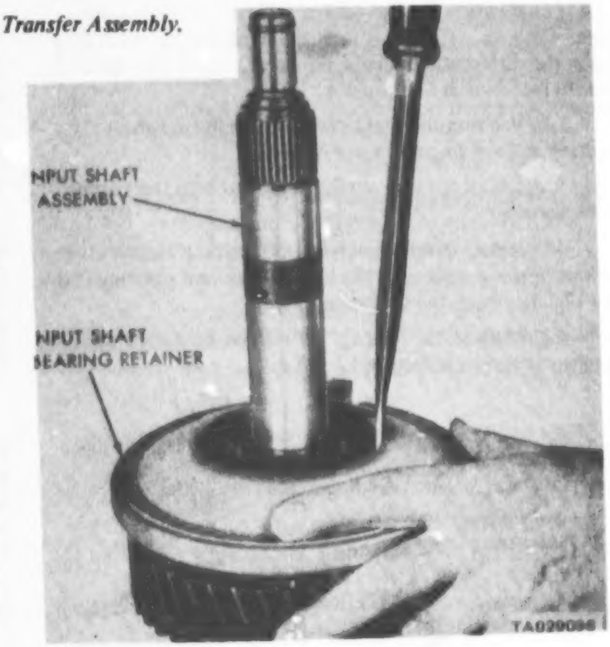


Figure 17-11. Removing Lockring.

(3) Clean and inspect all components. Replace worn or defective parts.

d. Disassembling the Differential Housing Assembly. Refer to figure 17-9, above.

(1) Remove the speedometer driven gear from the housing.

(2) Remove the yoke nut and washer (if not removed during disassembly). Remove the yoke.

(3) Tap the yoke end of the shaft with a soft hammer and remove the shaft from the housing. Remove the speedometer drive gear from the shaft. If it is not on the shaft, refer to step 5.

(4) Remove six capscrews and separate the rear output housing from the differential housing.

(5) Remove the shim pack from the rear face of the rear bearing. Also, remove the speedometer drive gear from the housing if it was not already removed with the rear output shaft. (Sometimes the shim pack and the speedometer drive gear will stay on the output shaft when it is removed.)

(6) With a screwdriver or other suitable tool, pry the seal out of the housing.

(7) Tap or press the bearing from the output housing (figure 17-12).

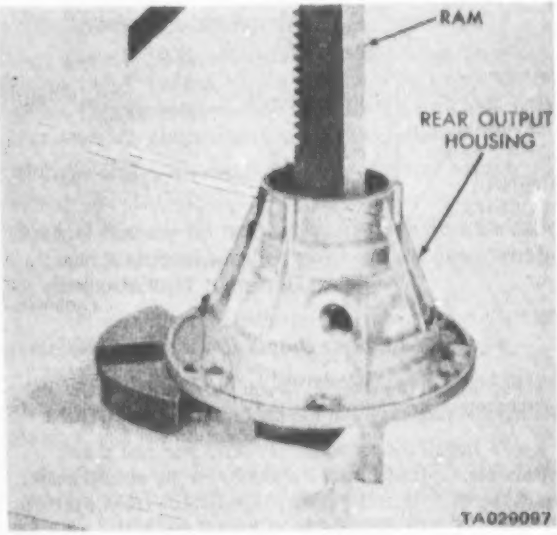


Figure 17-12. Pressing Rear Output Shaft Rear Bearing Out of Retainer.

(8) Using a brass drift, remove the bearing from the differential housing.

17-4. Reassembly and Installation of Subassemblies.

Refer to figure 17-9, above.

a. Rear Output Shaft and Differential Housing Assembly.

(1) Position the flat rubber seal ring in the bearing bore. Use grease to hold it in place. Position the roller bearing in the differential housing bore and press it in until the bearing bottoms in the housing.

(2) Position the rear bearing in the output shaft housing and tap or press it into place.

(3) Install the rear output shaft seal into the output shaft housing.

(4) Install two new seals on the inside surface of the output housing, centering the holes at the vent opening (figure 17-13). Stack the two seals.

(5) Position the sealing "O" ring on the differential housing as shown in (figure 17-13).

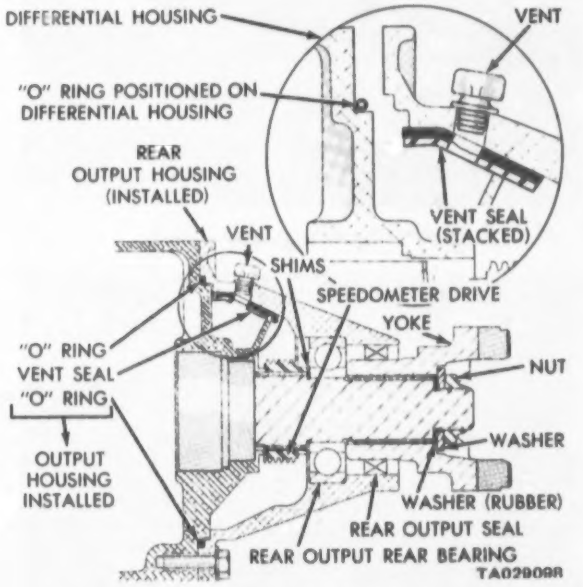


Figure 17-13. Rear Output Housing Assembly.

(6) Install the retainer housing assembly on the differential housing. Tighten the six capscrews to 30 ft-lbs.

(7) Install the speedometer drive gear and shims (approximately 0.050 inch thickness) on the output shaft. Install the shaft into the carrier through the front opening. (Be careful not to damage the pump oil seal.)

(8) Install the yoke, rubber seal, washer, and retaining nut. Leave the nut approximately 1/16-inch loose until the necessary shim thickness is determined.

(9) Install the speedometer drive gear in the case.

b. Range Selector Housing (Range Box).

(1) Installing the countershaft gear assembly.

(a) Using heavy grease for retention, install the roller bearings (72 required) and spacers in the counter gear bore.

(b) Using heavy grease, position the countershaft thrust washers in the case. Engage the tab on the washers with a slot in the case thrust surface.

(c) Position the countergear assembly in the case and install the countershaft into the gear assembly through the front face of the range box. The flat countershaft face should face forward and must be alined with the case gasket. (A 1.490-inch diameter dummy shaft will aid in reinstalling the countershaft.)

(2) Installing input gear assembly.

(a) Install a bearing (without the large snap ring) on the input gear shaft, positioning the snap ring groove outward. Install a new retaining ring on the shaft. Position the input gear and bearing in the housing. The retaining ring is a select fit. Use service ring size A, B, C, or D to provide the tightest fit.

(b) Install a snap ring into the groove in the outer diameter of the bearing.

(c) Aline the oil slot in the retainer with the drain hole in the case. Install the input gear bearing retainer, gasket, and retaining bolts. Tighten to 20 ft-lbs.

(3) Installing the shifter shaft assembly.

(a) If removed, install the detent plate and the pivot pin assembly in the housing. Use a sealant on the pin.

(b) Install new "O" rings on the inner and outer shafts. Lubricate the rings and assemble the inner shaft in the outer shaft.

(c) Push the shifter shafts into the housing, engaging the long end of the lockout clutch connector link to the outer shifter shaft before the shaft assembly bottoms out.

(d) Install the lockout shift lever and retaining ring.

(e) Install the range selector shift lever and the shift shaft retaining nut.

(f) Install the shift fork and the sliding clutch gear. Push the fork up into the shifter shaft assembly to engage the detent plate sliding the clutch gear forward onto the input shaft gear.

(g) Install the detent plate spring, gasket, and plate in the top of the housing. Check the spring engagement with the detent plate.

(4) Reassembling the input shaft assembly.

(a) Position a bearing on the retainer bore and press or tap it into place.

(b) Install a large snap ring retaining bearing in.

the retainer. Snap rings are a select fit. Use size A, B, C, or D to provide the tightest fit.

(c) Install a low speed gear on the shaft with the clutch end toward the gear end of the shaft.

(d) Position the thrust washers on the shaft, alining the slot in the washer with the pin in the shaft. Slide or tap the washer into place.

(e) Position the input bearing retainer on the shaft, and install a snap ring. Snap rings are a select fit. Use size A, B, C, or D to provide the tightest fit.

(f) Slide the spacer and thrust washer onto the shaft. Aline the spacer with the locator pin.

(g) Using heavy grease, install the roller bearings (15 required) in the end of the shaft.

(h) Install a new "O" ring on the end of the shaft.

(5) Reassembling the lockout clutch assembly.

(a) Install a spring cup washer, spring, and sliding clutch gear on the front side gear.

(b) Install the snap ring retaining sliding clutch to the front side gear.

(c) Using grease for retention, insert the roller bearings (123 required) and spacers in the front side gear.

(d) Install the thrust washer in the gear end of the front side gear.

(e) Slide the drive sprocket onto the clutch splines and install the retaining ring.

(6) Reassembling the differential carrier assembly.

(a) Using grease for retention, install the roller bearings (132 required, 33 on each pinion) into the pinion gears.

(b) Install the pinion roller washer and gear, and the roller washer and thrust washer on each leg of the spider.

(c) Place the spider assembly into the front half of the carrier with the undercut surface of the spider thrust surface facing down or toward the gear teeth.

(d) Aline the marks on the carrier sections and position the carrier halves together. Install retaining bolts and tighten to 55 ft-lbs.

17-5. Reassembly of the Transfer.

Refer to figures 17-9 and 17-14.

a. Place the range box on blocks with the front (input) side down (figure 17-15).

b. Position a gasket on the range box.

c. Install the lockout clutch and drive sprocket assembly on the input shaft.

d. Install the input shaft, lockout clutch, and drive sprocket assembly into the range box, alining the tab on the bearing retainer with the notch in the gasket.

e. Connect the lockout clutch shift rail to the connector link and position the rail in the housing bore (figure 17-15). Rotate the shifter shaft while lowering the shift rail into the housing to prevent the link and rail from being disconnected.

f. Install the drive chain in the chain housing, positioning it around the outer wall of the housing.

g. Install the chain housing on the range box (figure 17-16), engaging the shift rail channel of the housing to the shift rail. Position the chain on the input drive sprocket.

h. Install the front output sprocket in the case, engaging the drive chain to the sprocket. Rotate the clutch drive gear to aid in positioning the chain on the drive sprocket.

i. Install the shift fork on the clutch assembly and shift sprocket. Push the clutch assembly fully into the drive sprocket. Install the roll pin retaining shift fork to the shift rail.

j. Install the outer retainer ring on the front output shaft bearing and install the bearing into the housing bore.

k. Install the front output shaft bearing retainer, gasket, and retaining bolts.

l. Install the front output shaft seal, yoke, dust shield, rubber seal, washer, and retaining nut. Tap the dust shield back into place after installing the bolts in the flange.

m. Install the front output shaft rear bearing retainer gasket and retaining bolts. If the rear bearing was removed, position the new bearing to the outside face of the cover and press it into the cover until it's flush with the opening.

n. Install the differential carrier assembly on the input shaft with the carrier bolt head toward the rear of the shaft.

o. Install the rear output housing assembly, gasket, and retaining bolts (the load bearings in the pinion shaft).

p. With the yoke nut about 1/16-inch loose, push or tap the end of the rear output shaft into the unit. This will put the differential into close mesh for the next check. Check the rear output shaft end play as follows:

(1) Install the dial indicator on the rear housing (figure 17-17).

(2) Holding the rear yoke, rotate the front output shaft to determine the highest point of axial movement in the output shaft.

(3) Zero the dial indicator with the output shaft set at this high point.

(4) Pull up on the yoke to determine the end play of the shaft which is the gap between the bearing shoulders of the shaft and the housing.

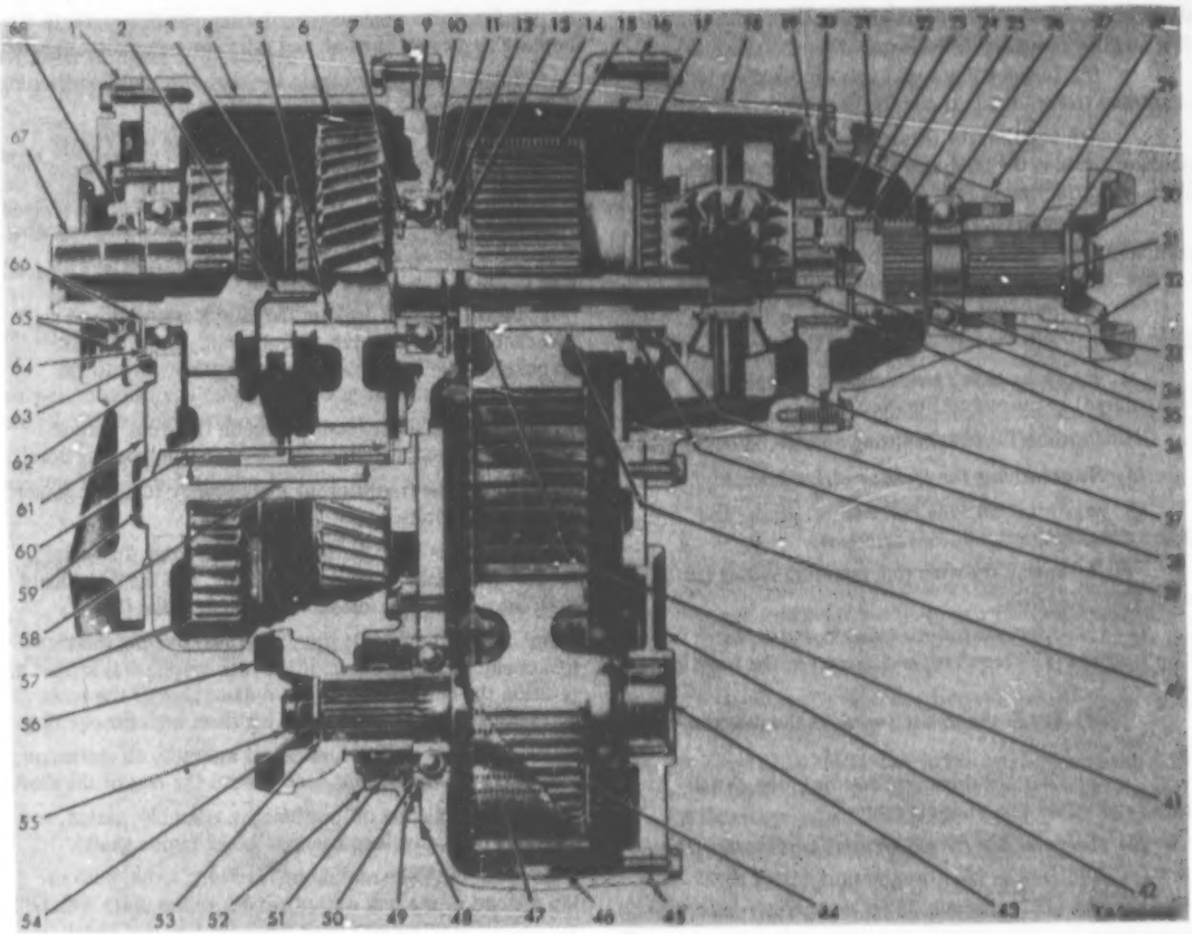
q. Remove the dial indicator and install the shim pack onto the shaft in the front of the bearing to get 0.010 inch end play. Hold the rear yoke and rotate the front output shaft to check for binding of the rear output shaft.

r. Install the lockout clutch shift rail detent ball, spring, and screw plug into the case.

s. Install the detent plate spring, gasket, and plug, if not installed during reassembly of the range box.

t. Install the shift levers on the range box shifter shaft.

u. Torque all bolts, nuts, and plugs (except the filler plug) as specified in table 17-1.



Legend for Figure 17-14:

1. Adapter
2. Input drive gear pilot bearings
3. Range selector sliding clutch
4. Range selector housing
5. Low speed gear bushing
6. Low speed gear
7. Thrust washer and locating pin
8. Gasket, range selector housing to intermediate housing
9. Input bearing retainer
10. Input bearing
11. Input bearing retaining ring (large)
12. Input bearing retaining ring (small)
13. Thrust washer, locating pin, lubricating washer and retaining ring
14. Intermediate (chain) housing
15. Drive shaft sprocket
16. Gasket, intermediate housing to differential housing
17. Sliding lock clutch
18. Differential housing
19. Rear output front bearing
20. "O" ring, differential housing to rear output shaft housing
21. Vent
22. Oil seal, rear output front bearing
23. Oil seal, vent
24. Oil pump
25. Speedometer drive gear
26. Rear output rear bearing
27. Rear output shaft housing
28. Rear output shaft
29. Washer, rear output
30. Nut, rear output
31. Rubber washer, rear output
32. Rear output yoke
33. Oil seal, rear output bearing
34. Shim pack
35. Input shaft "O" ring seal
36. Input shaft roller bearings
37. Differential carrier assembly
38. Spring cup washer
39. Lockout clutch spring
40. Rear retaining ring, drive shaft sprocket
41. Front retaining ring, drive shaft sprocket
42. Front output rear bearing cover
43. Front output rear bearing
44. Front output drive sprocket
45. Gasket, front output rear bearing cover
46. Magnet
47. Drive chain
48. Gasket, front output bearing retainer
49. Front output bearing outer retaining ring
50. Front output bearing
51. Front output shaft seal
52. Front output bearing retainer
53. Rubber spline seal
54. Washer, front output
55. Nut, front output
56. Front output yoke
57. Countergear
58. Countergear spacers and bearings
59. Countergear shaft
60. Countergear thrust washer
61. Gasket, adapter to selector housing
62. Gasket, input bearing retainer
63. Input bearing outer ring
64. Input gear bearing
65. Input gear seals
66. Input bearing retaining ring
67. Input gear
68. Input gear bearing retainer

Figure 17-14. Transfer Assembly (Cross Section).

v. Fill the transfer case to the proper level with specified lubricant and install the filler plug.

w. Carefully check the transfer case for leaks. If leakage is visible at any bolt head, remove the bolt, clean and recoat it with a suitable sealant coating, and reinstall.

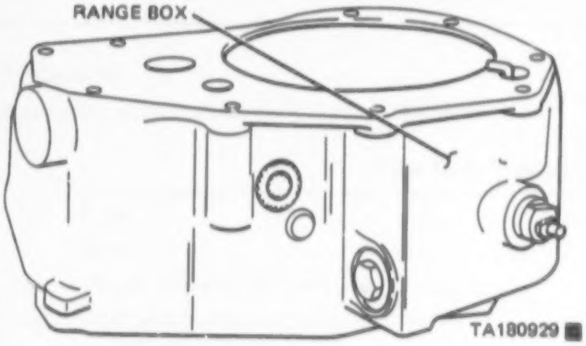


Figure 17-15. Range Box Positioned for Assembly.

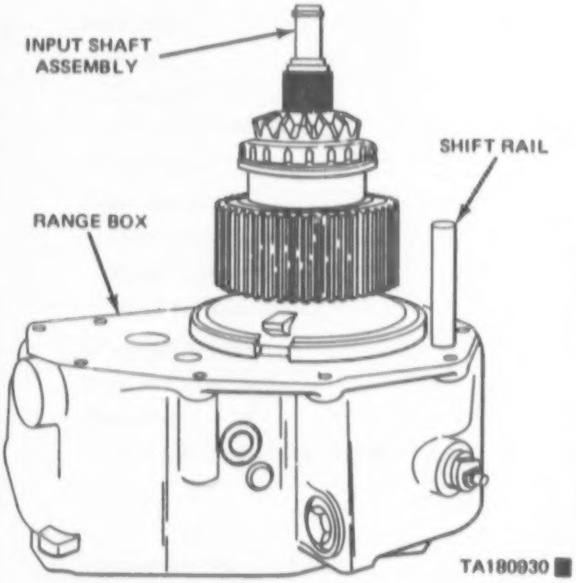


Figure 17-16. Shift Rail in Installed Position.

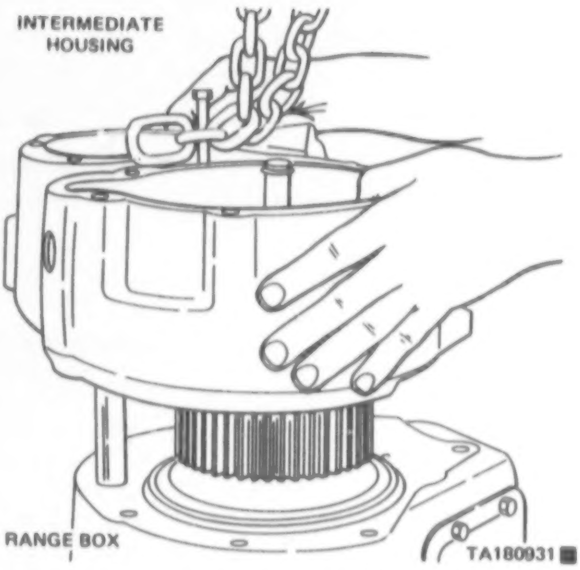


Figure 17-17. Installing Intermediate Housing on Range Box.

Table 17-1. Torque Specifications

Location	Ft-lbs
Adapter to transmission attaching bolt	31
Adapter to transfer case attaching bolts	30
Range box to chain case	30
Differential housing to chain case	30
Front input bearing retainer bolts	20
Front output front bearing retainer bolts	30
Front output rear bearing retainer bolts	30
Differential carrier bolt	55
Rear output bearing retainer assembly bolts	30
Output shaft yoke nuts	120
Lockout shift poppet plug	20
Range shift poppet plug	20
Power take-off cover bolts	15
Shifter assembly to adapter bolts	30
Shift lever to shifter assembly nut	30
Knob assembly jam nut	10
Range and locknut shift lever locknut	20
Swivel rod clamp lockscrews	11
Filler plug	30

CHAPTER 18

REPAIR OF THE TRANSMISSION

18-1. General.

Transmission specifications are shown in table 18-1.

Table 18-1. Transmission Specifications

Type	3-speed, fully automatic
Model	A-727
Torque converter diameter	11-3/4 in
Oil capacity of transmission and torque converter (Dexron)	19 pts
Method of cooling	Oil cooling coil in bottom radiator tank
Lubrication	Pump (rotor type)
Gear ratios	
1-Low	2.45:1
2-Second	1.45:1
D-Drive	1:1
R-Reverse	2.20:1
Pump clearances	
Outer rotor to case bore	0.004 to 0.008 in
Outer to inner tip	0.005 to 0.010 in
End clearance-rotors	0.0015 to 0.003 in
Gear train end play	0.010 to 0.025 in
Input shaft end play	0.036 to 0.082 in
Snap rings	
Rear clutch snap ring (selective)	0.060 to 0.062 in 0.074 to 0.076 in 0.088 to 0.090 in 0.106 to 0.108 in
Output shaft (forward end)	0.048 to 0.052 in 0.055 to 0.059 in 0.062 to 0.066 in

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18-2. Starter Ring Gear Replacement.

The starter ring gear is mounted directly on the outer diameter of the torque converter front cover. Remove the torque converter from the vehicle, and replace the gear as follows:

a. Removal.

(1) Cut through the weld material at the rear of the ring gear with a hack saw or grinding wheel (figure 18-1). Be careful not to cut or grind into the front cover stamping.

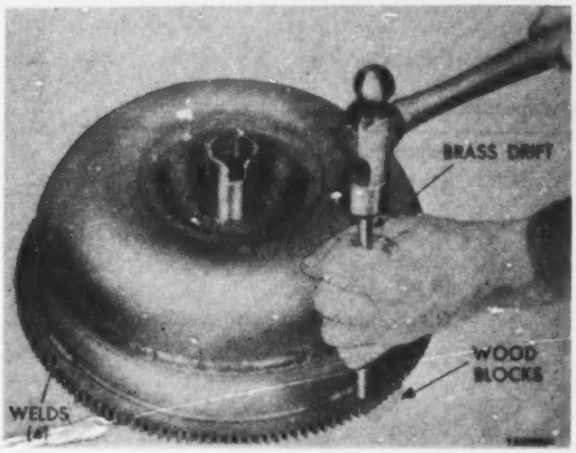


Figure 18-1. Removing Starter Ring Gear.

(2) Scribe a heavy line on the front cover next to the front face of the ring gear to aid in locating the new gear.

(3) Support the converter with the front lug faces resting on blocks of wood. The converter must not rest on the front cover hub during this operation. Using a blunt chisel or drift and hammer, tap down on the ring gear near the welded areas to break any remaining weld material (figure 18-1). Tap around the ring gear until it comes off the converter.

(4) Smooth off the welded areas on the cover with a file.

b. Preparing for Installation. Any of the following methods may be used to heat and expand the starter ring gear in order to install it on the converter.

(1) Oven. Place the ring gear in an oven and set the temperature at 200° F. Allow the ring gear to remain in the oven for 15 to 20 minutes.

(2) Boiling water. Place the ring gear in a shallow container, add water, bring the water to a boil, and heat for approximately 8 minutes.

(3) Steam. Place the ring gear on a flat surface and direct a steam flow around the gear for approximately 2 minutes.

(4) Flame. Place the ring gear squarely on a flat surface. Using a medium size tip, direct a slow flame evenly around the inner rim of the gear. Do not apply the flame to the gear teeth. Place a few drops of water on the face of the gear at intervals during the heating process. When the water is hot enough to just boil, the gear heating is complete.

c. Installation.

(1) After the ring gear is expanded by heating, place it in position on the converter front cover. Tap the gear with a plastic or rawhide mallet until it is even with the scribed line (made during removal) on the front cover. Make sure the gear is even around the full circumference of the front cover.

(2) Reweld the ring gear to the torque converter front cover. Be careful to place, as nearly as possible, the same amount of weld material in exactly the same location as was used in the original weld. This is necessary in order to maintain proper balance of the unit. Place the welds alternately on opposite sides of the converter to minimize distortion.

(3) Follow these rules when making the weld:

(a) Do not gas weld.

(b) Use a d.c. welder that is set at straight polarity, or an a.c. welder if the proper electrode is available.

(c) Use a 1/8-inch diameter welding rod and a welding current of 80 to 125 amps.

(d) Direct the arc at the intersection of the gear and front cover at a 45 degree angle from the rear face of the gear.

(4) Inspect the gear teeth and remove all nicks where the metal is raised, or where there is weld metal splatter, etc., in order to insure quiet starter operation.

18-3. Torque Converter Flushing.

a. General. When a transmission failure has contaminated the fluid, flush the torque converter, oil coolers, and tubes. This will insure that metal particles or sludged oil are not later transferred back into the reconditioned transmission.

b. Hand Flushing.

(1) Place the converter in a horizontal position and pour 2 quarts of new, clean solvent or kerosene into the converter through the impeller hub.

(2) Turn and shake the converter to swirl the solvent through the internal parts. Turn the turbine and stator to dislodge any foreign material, using the transmission input and reaction shafts.

(3) Position the converter in its normal operating position with the drain plug at the lowest point. Remove the drain plug and drain the solvent. Rotate the turbine and stator and shake the converter while draining, to prevent dirt particles from settling.

(4) Repeat the flushing operation at least one more time, or as many times as required until the drained solvent or kerosene is clear.

(5) After flushing, shake and rotate the converter several times with the drain plug out to remove any residual solvent and dirt. Flush any remaining solvent from the converter with 2 quarts of new transmission fluid. This will prevent any adverse effect the solvent may have on the transmission seals. Reinstall the drain plug and tighten to 90 in-lbs.

(6) Flush and blow out the oil cooler and its lines (paragraph 18-4).

18-4. Flushing Oil Cooler and Tubes.

a. General. When a transmission failure has contaminated the fluid, flush the oil cooler to insure that metal particles or sludged oil are not later transferred back into the reconditioned transmission.

b. Procedure.

(1) Place a length of hose over the end of the back oil cooler tube. Insert the other end securely into a waste oil container.

(2) Apply compressed air to the forward oil cooler tube in very short, sharp blasts.

(3) Pump approximately 1 pint of automatic transmission fluid into the forward oil cooler tube.

(4) Remove the hose.

18-5. Replacing the Pump Oil Seal.

a. General. The transmission pump oil seal can be replaced without removing the pump and reaction shaft support assembly from the transmission case.

b. Procedure.

(1) Screw a seal remover (tool C-3861) into the seal as shown in figure 18-2.

Figure 18-2. Removing Pump Oil Seal.

(2) Place a new seal in the opening of the pump housing with its lip facing inward. Use tool C-3860 to drive the seal into the housing until the tool bottoms (figure 18-3).

18-6. Disassembling the Transmission.

a. Removing Subassemblies. Before removing any transmission subassemblies, plug all openings and thoroughly clean the unit's exterior. Steam cleaning is preferred. Cleanliness through the entire disassembly and assembly procedures is extremely important. Follow these rules:

(1) When disassembling, wash each part in a suitable solvent and then dry it with compressed air.

Figure 18-3. Installing Pump Oil Seal.

CAUTION

DO NOT wipe parts dry with shop towels.

(2) Be extremely careful when handling parts. All transmission mating surfaces are accurately machined; careless handling will cause nicks and burrs.

b. Input Shaft End Play. Measuring input shaft end play before disassembly will usually indicate when a thrust washer change is required (except when major parts are replaced). The thrust washer is located between the reaction shaft support and the front clutch retainer.

(1) Attach a dial indicator to the transmission bell housing with the plunger seated against the end of the input shaft (figure 18-4).

Figure 18-4. Measuring Input Shaft End Play.

(2) Move the input shaft in and out to obtain end play reading. End play specifications are 0.036 to 0.084 inch for transmissions.

(3) Record the indicator reading for reference when reassembling the transmission.

c. Oil Pan.

(1) Place the transmission assembly in a repair stand (figure 18-5), or securely position it on blocks.

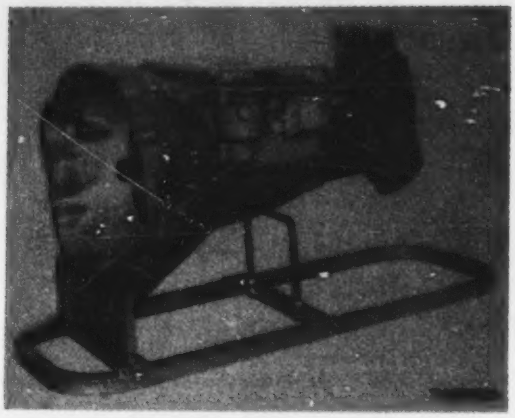


Figure 18-5. Transmission Installed in Repair Stand.

(2) Unscrew the oil pan bolts and remove the oil pan and gasket.

d. Valve Body Assembly.

(1) Loosen the clamp bolts and remove the throttle and gearshift levers from the transmission.

(2) Remove the back-up light and neutral safety switch.

(3) Remove the 10 valve-body-to-transmission bolts. Remove the "E" clip securing the parking lock rod to the valve body manual lever.

(4) While lifting the valve body upward out of the transmission case, disconnect the parking lock rod from the lever.

e. Accumulator Piston and Spring. Lift the spring off the accumulator piston and withdraw the piston from the case.

f. Extension Housing and Output Shaft Bearing. Before removing the extension housing, pull the parking lock rod forward out of the case. Rotate the propeller shaft if necessary to aline the parking gear and sprag. This will permit the knob on the end of the control rod to pass the sprag. Then proceed as follows:

(1) Remove the speedometer pinion and adapter assembly.

(2) On 4X4 models with short extension housing, remove the extension housing-to-transmission bolts and tap the housing lightly to break it loose. Remove the housing and bearing assembly.

(3) On 4X2 models with long extension housing, remove the extension housing-to-transmission bolts. Remove the access plate and gasket from the bottom or side of the extension housing mounting pad. Spread the large snap ring from the output shaft bearing with snap pliers. With the snap ring spread as far as possible, carefully tap the extension housing off the output shaft and bearing.

(4) Using heavy duty snap ring pliers, remove the output shaft bearing rear snap ring. Remove the bearing from the shaft. Remove the front snap ring.

g. Governor and Support.

(1) Carefully pry the small snap ring from the weight end of the governor valve shaft. Slide the valve and shaft assembly out of the governor body.

(2) Remove the snap ring from behind the governor body. Then slide the governor body and support assembly off the output shaft.

h. Oil Pump and Reaction Shaft Support.

(1) Tighten the front band adjusting screw until the band is tight on the front clutch retainer. This prevents the clutch retainer from coming out with the pump, which might cause unnecessary damage to the clutches.

(2) Remove the oil pump housing retaining bolts.

(3) Using puller set C-3752, remove the pump housing flange as shown in figure 18-6.

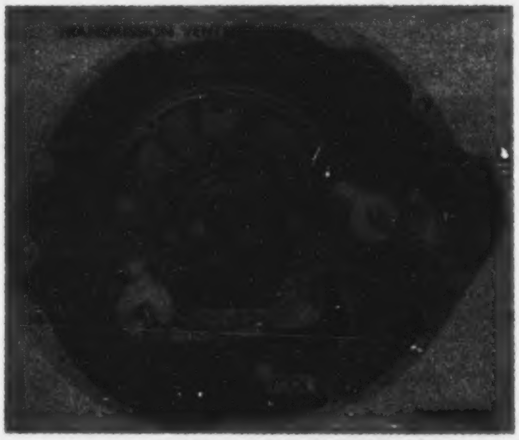


Figure 18-6. Removing Pump and Reaction Shaft Support Assembly.

(4) Evenly bump out the pump and reaction shaft support assembly with two "knocker weights" and remove them from the case.

i. Front Band and Front Clutch.

(1) Loosen the front band adjuster, remove the band strut, and slide the band out of the case.

(2) Slide the front clutch assembly out of the case.

j. Input Shaft and Rear Clutch. Grasp the input shaft and slide the shaft and rear clutch assembly out of the case.

NOTE

Be careful not to lose the thrust washer located between the rear end of the input shaft and the forward end of the output shaft.

k. Planetary Gear Assemblies, Sun Gear, and Driving Shell.

(1) While supporting the output shaft and driving shell, carefully slide the assembly forward and out through the case.

(2) Be very careful not to damage the ground surface on the output shaft during removal.

l. Rear Band and Low-Reverse Drum. Remove the low-reverse drum, then loosen the rear band adjuster and remove the band strut and link. Remove the band from the case.

m. Overrunning Clutch.

(1) Before disassembly, note the position of the overrunning clutch rollers and springs in order to position them in reassembly.

(2) Carefully slide out the clutch hub and remove the rollers and springs. If the overrunning clutch cam and/or roller spring retainer are found damaged or worn, refer to replacement procedures in paragraph 18-12.

n. Kickdown Servo (Front).

(1) Compress the kickdown servo spring by using an engine valve spring compressor. Then remove the snap ring as shown in figure 18-7.

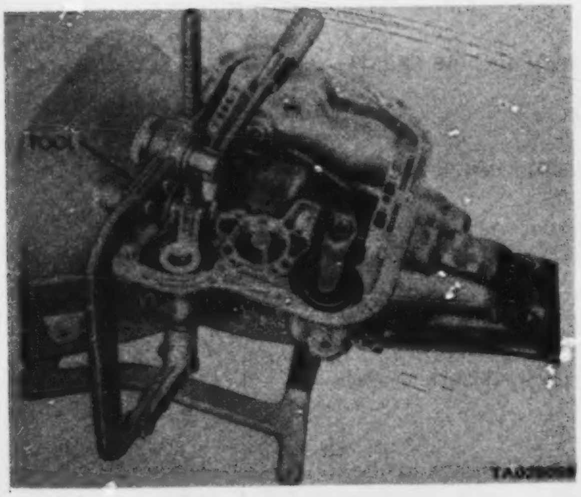


Figure 18-7. Compressing Kickdown Servo Spring.

(2) Remove the rod guide, springs, and piston rod from the case. Be careful not to damage the piston rod or guide during removal.

(3) Withdraw the piston from the transmission case.

(4) Disassemble the "controlled load" servo piston assembly by removing the small snap ring from the servo piston. Then remove the washer, spring, and piston rod from the servo piston.

o. Low and Reverse Servo (Rear).

(1) Compress the low and reverse servo piston spring using the engine valve spring compressor. Remove the snap ring.

(2) Remove the spring retainer, spring, and servo piston and plug assembly from the case.

18-7. Reconditioning Subassemblies.

a. The following procedures cover disassembly, inspection, repair, and assembly of each subassembly as removed from the transmission.

b. Heli-Coil or equivalent inserts are recommended for repairing damaged, stripped, or worn threads in aluminum parts (see table 4-3).

c. Pre-sized service bushings are available for replacement for almost all bushings in the transmission. The two bushings in the sun gear are not serviced because of the low cost of the sun gear assembly. If bushings are found worn or scored, replace them as outlined in the following reconditioning procedures.

d. Use of crocus cloth is permissible where necessary, provided it is used carefully. When used on valves, be extremely careful to avoid rounding off the sharp edges. A sharp edge is vitally important to this type of valve. They prevent dirt and foreign matter from getting between the valve and body, thus reducing the possibility of sticking. When it becomes necessary to recondition the transmission, and the truck has accumulated considerable mileage, install new seal rings on parts requiring their usage.

NOTE

Coat each part with automatic transmission fluid during assembly.

18-8. Oil Pump and Reaction Shaft Support.

a. Disassembly. Refer to figure 18-8.

(1) Remove the bolts from the rear side of the reaction shaft support and lift the reaction shaft support off the pump.

(2) Remove the rubber seal ring from the pump body flange.

(3) Drive out the oil seal with a blunt punch.

b. Inspection Procedure.

(1) Look for wear or broken locks on the interlocking steel rings mounted on the reaction shaft support (figure 18-8). Make sure they turn freely in the grooves.

(2) Inspect all machined surfaces on the pump body and reaction shaft support for nicks and burrs.

(3) Look for wear or scores on the pump body and reaction shaft support bearings.

(4) Inspect the pump rotors for scoring or pitting.

(5) Clean the rotors and install them in the pump body. Then place a straightedge across the face of the rotors and pump body. Use a feeler gage to measure the clearance between the straightedge and the rotor faces. Clearances between 0.0015 and 0.0030 inch are satisfactory.

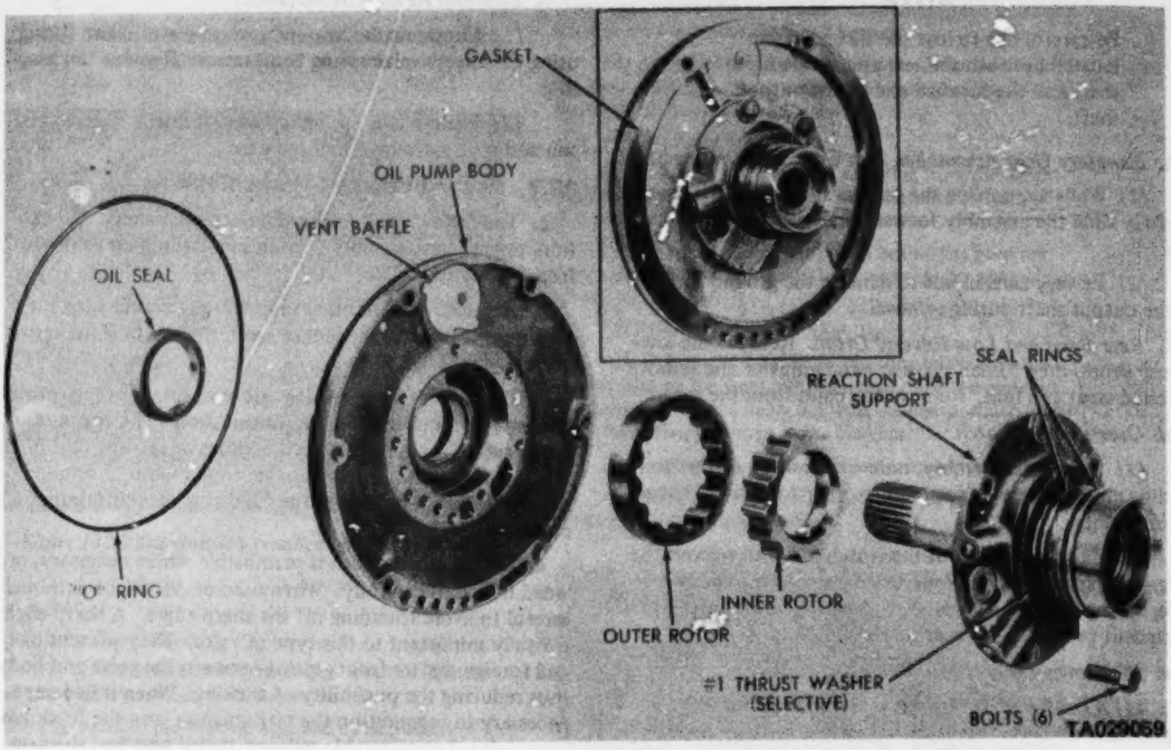

GASKET
OIL PUMP BODY
VENT BAFFLE
OIL SEAL
"O" RING
SEAL RINGS
REACTION SHAFT SUPPORT
INNER ROTOR
OUTER ROTOR
#1 THRUST WASHER (SELECTIVE)
BOLTS (6)
TA029059

Figure 18-8. Oil Pump and Reaction Shaft Support.

(6) Measure the clearance between the inner and outer teeth and the rotor tip. Clearances between 0.005 and 0.010 inch are satisfactory.

(7) Measure the clearance between the outer rotor and its bore in the oil pump body. Clearances between 0.004 and 0.008 inch are satisfactory.

c. Replacing the Pump Bushing.

(1) Place the pump housing on a clean, smooth surface, with the rotor cavity down.

(2) Place removing head tool SP-3550 in the bushing, and install handle tool C-4171 in the removing head (figure 18-9).

(3) Drive the bushing straight down and out of the bore. Be careful not to cock the tool in the bore.

(4) Position a new bushing on installing head tool SP-5118.

(5) With the pump housing on a smooth clean surface (hub end down), start the bushing and installing head into the bushing bore. Install handle tool C-4171 in the installing head.

(6) Drive the bushing into the housing until the tool bottoms in the pump cavity. Be careful not to cock the tool during installation.

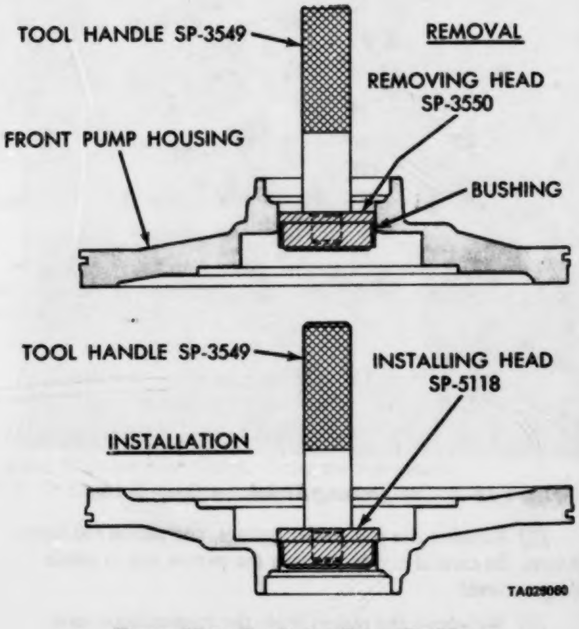

TOOL HANDLE SP-3549
REMOVAL
REMOVING HEAD SP-3550
FRONT PUMP HOUSING
BUSHING
TOOL HANDLE SP-3549
INSTALLING HEAD SP-5118
INSTALLATION
TA029060

Figure 18-9. Replacing Pump Bushing.

(7) Stake the bushing in place by using a blunt punch or similar tool, gently tapping at each stake slot location (figure 18-10).

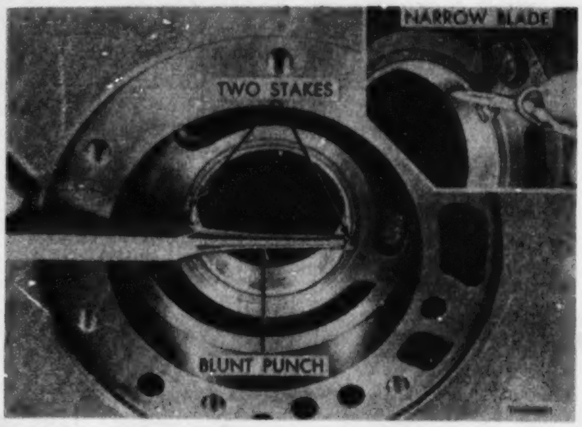

NARROW BLADE
TWO STAKES
BLUNT PUNCH

Figure 18-10. Staking Pump Bushing.

(8) Using a narrow-bladed knife or similar tool, remove high points or burrs around the staked area. Do not use a file or similar tool that will remove more metal than is necessary.

(9) Thoroughly clean the pump housing before installation.

d. Replacing the Reaction Shaft Bushing.

(1) Assembly remover tool SP-5301, cup tool SP-3633, and hex nut tool SP-1191 (figure 18-11).

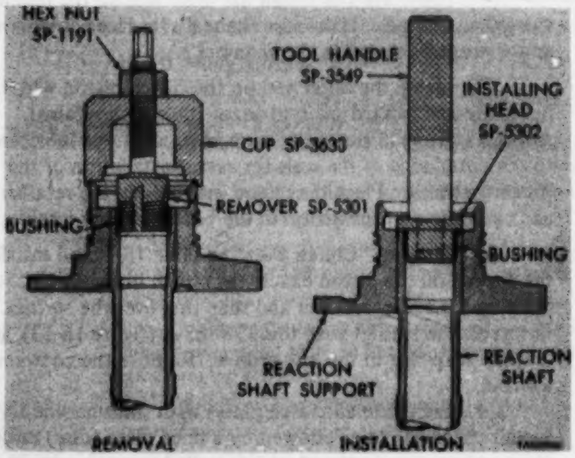

HEX NUT SP-1191
TOOL HANDLE SP-3549
INSTALLING HEAD SP-5302
CUP SP-3633
REMOVER SP-5301
BUSHING
BUSHING
REACTION SHAFT SUPPORT
REACTION SHAFT
REMOVAL
INSTALLATION

Figure 18-11. Replacing Reaction Shaft Bushing.

NOTE

Do not clamp any part of the reaction shaft or support in a vise.

(2) With the cup held firmly against the reaction shaft, thread the remover into the bushing as far as possible by hand.

(3) Use a wrench to screw the remover into the bushing three to four additional turns to firmly engage the threads in the bushing.

(4) Turn the hex nut down against the cup to pull the bushing from the reaction shaft. Thoroughly clean the reaction shaft to remove any chips made by remover threads.

(5) Lightly grip the bushing in a vise or with pliers, and back the tool out of the bushing. Be careful not to damage threads on the bushing remover.

(6) Slide a new bushing (chamfered end first) onto installing head tool SP-5302, and start it into the bore of the reaction shaft.

(7) Support the reaction shaft upright on a clean, smooth surface and install handle tool C-4171 in the installing head. Drive the bushing into the shaft until the tool bottoms.

(8) Thoroughly clean the reaction shaft support assembly before installation.

e. Assembling the Oil Pump and Reaction Shaft Support.

(1) Assemble the pump rotors and "O" ring in the pump housing.

(2) Install the reaction shaft support. Install retaining bolts and tighten them to 160 in-lbs.

(3) Place a new oil seal in the opening of the pump housing (lip of the seal facing inward), using tool C-3860 as shown in figure 18-3. Drive the seal into the housing until the tool bottoms.

18-9. Front Clutch.

a. Disassembly. Figure 8-12 shows a disassembled view of the front clutch assembly.

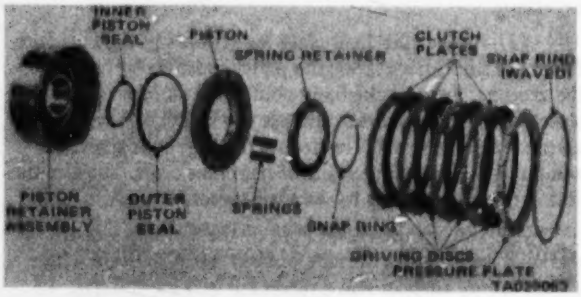

INNER PISTON SEAL
PISTON
SPRING RETAINER
CLUTCH PLATES
SNAP RING (WAVED)
PISTON RETAINER ASSEMBLY
OUTER PISTON SEAL
SPRINGS
SNAP RING
DRIVING DISCS
PRESSURE PLATE

Figure 8-12. Front Clutch.

(1) Remove the large waved snap ring that secures the pressure plate in the clutch piston retainer. Lift the pressure plate and clutch plates out of the retainer.

(2) Install compressor tool C-3863-A over the piston spring retainer (figure 18-13). Compress the springs and remove the snap ring. Then slowly release the tool until the spring retainer is free of the hub. Remove the tool, retainer, and springs.

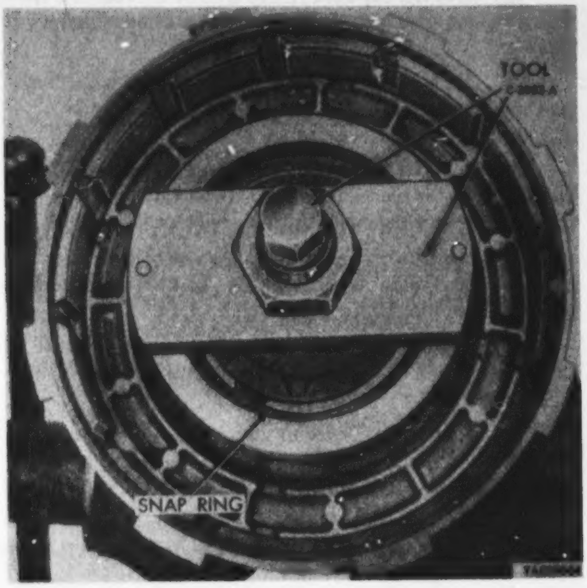


Figure 18-13. Removing or Installing Front Clutch Spring Retainer Snap Ring.

(3) Invert the clutch retainer assembly and bump it on a wood block to remove the piston. Remove the seals from the piston and clutch retainer hub.

b. Inspection.

(1) Inspect the plates and discs for flatness. They must not be warped or cone-shaped. Inspect facing material on all driving discs. Replace discs that are charred, glazed, or heavily pitted. Replace discs if they show evidence of material flaking off, or if facing material can be easily scraped off. Inspect the driving disc splines for wear or other damage. Inspect steel plate and pressure plate surfaces for burning, scoring, or damaged driving lugs. Replace if necessary.

(2) Inspect the steel plate lug grooves in the clutch retainer for smooth surfaces; the plates must travel freely in the grooves. Inspect the band-contacting surface on the clutch retainer for scores. Inspect the ball check in the clutch retainer for nicks or deep scratches; light scratches will not interfere with sealing of neoprene seals. Inspect the clutch retainer bushing for wear or scores.

(3) Inspect the inside bore of the piston for score marks; if only light scores are present, remove them with crocus cloth. Inspect seal grooves for nicks and burrs. Inspect neoprene seals for deterioration, wear, and hardness. Inspect the piston springs, retainer, and snap ring for distortion.

c. Replacing the Front Clutch Retainer Bushing.

(1) Lay the clutch retainer (open end down) on a clean, smooth surface and place removing head tool SP-3629 in the bushing Install handle tool C-4171 in the removing head (figure 18-14).

(2) Drive the bushing out of the clutch retainer bore. Be careful not to cock the tool in the bore.

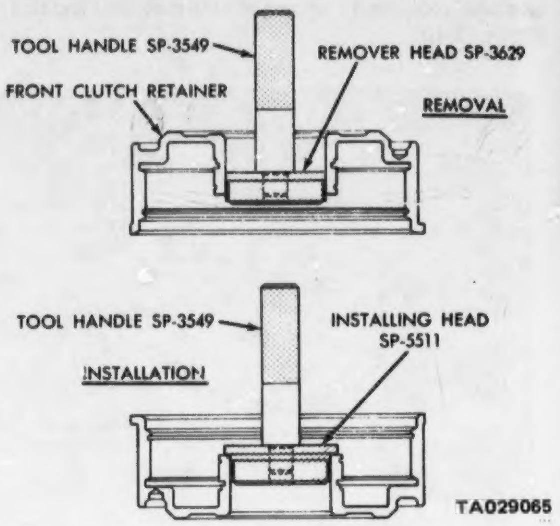


Figure 18-14. Replacing Front Clutch Retainer Bushing.

(3) Lay the clutch retainer (open end up) on a clean, smooth surface. Slide a new bushing on installing head SP-5511 and start it into the clutch retainer bore.

(4) Install handle tool C-4171 in the installer. Drive the bushing into the clutch retainer until the tool bottoms.

(5) Thoroughly clean the clutch retainer before assembly and installation.

d. Assembly.

(1) Lubricate and install the inner seal on the hub of the clutch retainer. Make sure the seal's lip faces downward and is properly seated in the groove.

(2) Install the outer seal on the clutch piston with the lip of the seal toward the bottom of the clutch retainer. Apply a coating of non-petroleum-base, wax-type lubricant to the outer edge of the seals for easier installation of the piston assembly. Place the piston assembly in the retainer and carefully seat the piston in the bottom of the retainer.

(3) Refer to "Clutch Data" in table 18-2, and install the springs on the piston exactly as shown in figure 18-15. Position the spring retainer and snap ring over the springs. Compress the springs with tool C-3863-A (figure 18-13), and seat the snap ring in the hub groove. Remove the compressor tool.

(4) Lubricate all clutch plates with transmission fluid. Install one steel plate followed by a lined plate (disc) until the number given in the chart is installed (see table 18-2). Install the pressure plate and snap ring. Make sure the snap ring is properly seated.

(5) With the front clutch completely assembled, insert a feeler gage between the pressure plate and the snap ring (figure 18-16). The maximum clearance should be within limits given in table 18-2.

Table 18-2. Clutch Data

Front clutch	
Number of discs	4
Clearance	0.088" to 0.145"
Number of springs	9
Rear clutch	
Number of discs	4
Clearance	0.025" to 0.045"
Number of springs	1
Band adjustments	
Kickdown band (front)	
Initial torque	72 in-lbs
Subsequent backoff	2 turns
Low-reverse band (internal)	
Initial torque	72 in-lbs
Subsequent backoff	2-1/2 turns

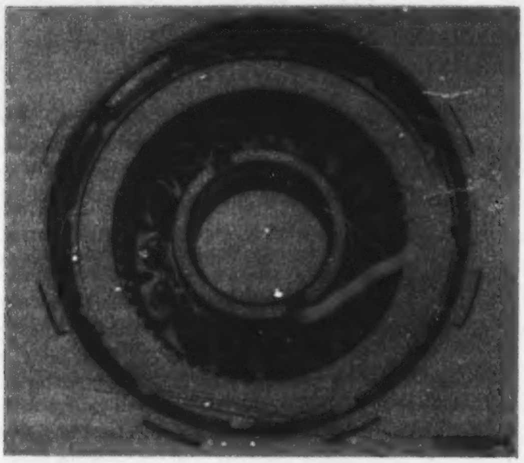


Figure 18-15. Front Clutch Spring Location (Nine Springs).

18-10. Rear Clutch.

a. Disassembly. Figure 18-17 shows a disassembled view of the rear clutch assembly.

(1) Remove the large selective snap ring that secures the pressure plate in the clutch retainer. Lift the pressure plate, clutch plates, and inner pressure plate out of the retainer.

(2) Carefully pry one end of the wave spring out of its groove in the clutch retainer. Then remove the wave spring, spacer ring, and clutch piston spring.

(3) Invert the clutch piston retainer assembly and bump it on a wood block to remove the piston. Remove all seals from the piston.

(4) If necessary, remove the snap ring and press the input shaft from the clutch piston retainer.

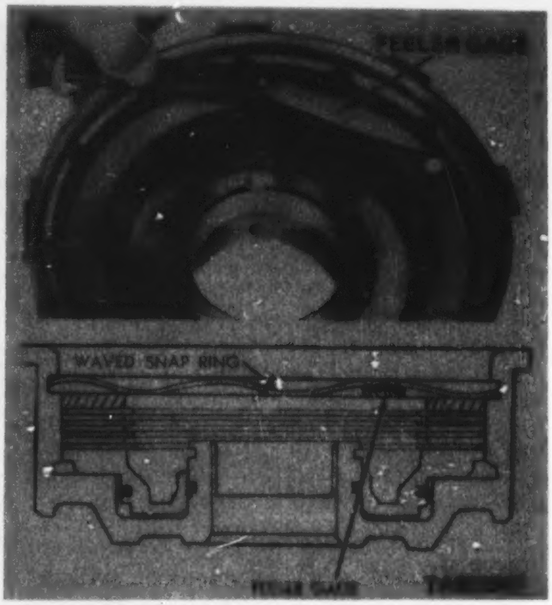


Figure 18-16. Measuring Front Clutch Plate Clearance.

b. Inspection Procedures.

(1) Check the facing material on all driving discs. Replace any discs that are charred, glazed, or heavily pitted. Also look for evidence of material flaking off the discs; replace discs with flaking material or with material that can be easily scraped off. Check the driving disc splines for wear or other damage, and replace if necessary.

(2) Inspect steel plate and pressure plate surfaces for burning, scoring, or damaged driving lugs. Replace if necessary.

(3) In the clutch retainer, check all steel plate lug grooves for smooth surfaces. The plates must travel freely in the grooves.

(4) Inspect the ball check in the piston; make sure the ball moves freely.

(5) In the clutch retainer, check all seal surfaces for nicks or deep scratches; light scratches will not interfere with sealing of neoprene seals.

(6) Inspect the neoprene seals for deterioration, wear, and hardness.

(7) Inspect the piston spring, wave spring, and spacer for distortion or breakage.

(8) Inspect the interlocking seal rings on the input shaft for wear or broken locks. Make sure they turn freely in the grooves. Do not remove and replace these rings unless they are worn or are binding.

(9) Inspect the input shaft bushing for wear or scores. Replace if necessary (*c*, below).

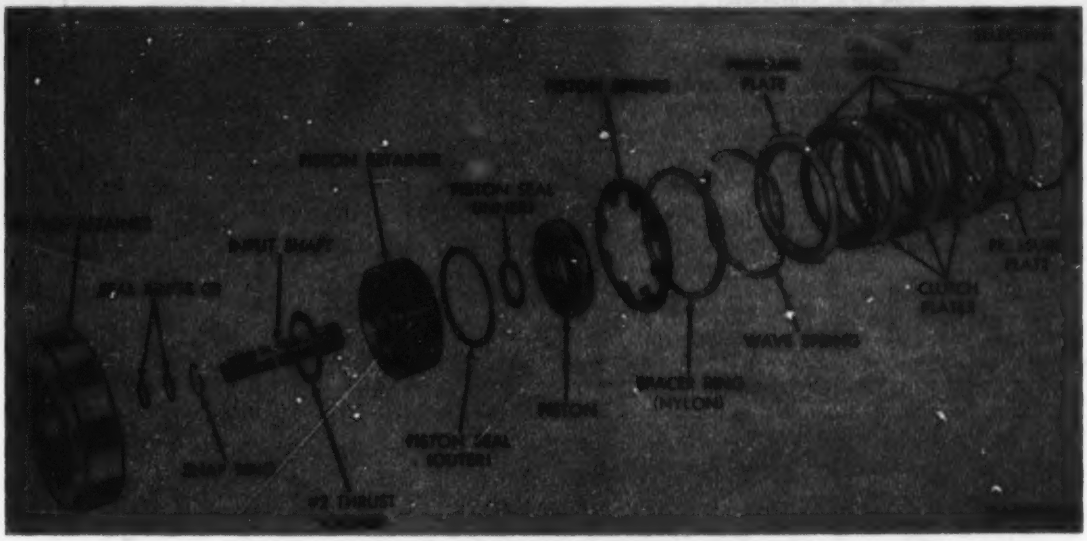

CLUTCH RETAINER
SEAL RINGS (2)
SNAP RING
INPUT SHAFT
#2 THRUST
PISTON RETAINER
PISTON SEAL (OUTER)
PISTON SEAL (INNER)
PISTON
PISTON SPRING
SPACER RING (NYLON)
PRESSURE PLATE
WAVE SPRING
CLUTCH PLATES
PRESSURE PLATE

Figure 18-17. Rear Clutch.

(10) Check for wear at the rear-clutch-to-front-clutch washer. If the washer is not 0.061 to 0.063 inch thick, replace it.

c. Replacing the Input Shaft Bushing.

(1) Clamp the input shaft in a vise that has soft jaws. Be careful not to clamp onto the seal ring lands or bearing journals.

(2) Assemble remover tool SP-3630, cup tool SP-3633, and hex nut tool SP-1191 as shown in figure 18-18.

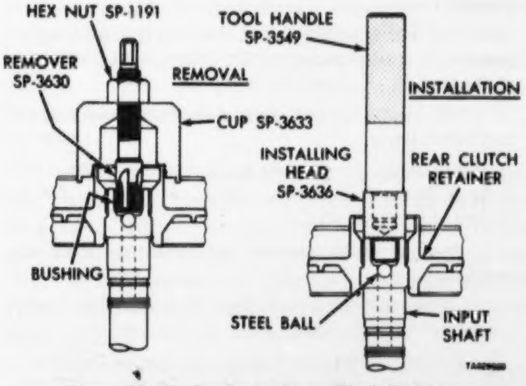

HEX NUT SP-1191
REMOVER SP-3630
REMOVAL
CUP SP-3633
BUSHING
TOOL HANDLE SP-3549
INSTALLATION
INSTALLING HEAD SP-3636
REAR CLUTCH RETAINER
STEEL BALL
INPUT SHAFT

Figure 18-18. Replacing Input Shaft Bushing.

(3) With the cup held firmly against the clutch piston retainer, thread the remover into the bushing as far as possible by hand.

(4) Use a wrench to screw the remover into the bushing three to four additional turns, to firmly engage the threads in the bushing.

(5) Turn the hex nut down against the cup to pull the bushing from the input shaft.

(6) Thoroughly clean the input shaft to remove any chips made by the remover threads. Make certain the small lubrication hole next to the ball in the shaft end is not plugged with chips. Be sure no chips are lodged next to the steel ball.

(7) Slide a new bushing onto installing head tool SP-3636 and start into the bore of the input shaft.

(8) Stand the input shaft upright on a clean, smooth surface and install handle tool C-4171 in the installing head. Drive the bushing into the shaft until the tool bottoms.

(9) Thoroughly clean the input shaft and clutch piston retainer before assembly and installation.

d. Assembly.

(1) If it was removed, press the input shaft into the clutch piston retainer and install the snap ring.

(2) Lubricate and install the inner and outer seal rings on the clutch piston. Make sure the lips of the seals face toward the head of the clutch retainer, and are properly seated in the piston grooves as shown in figure 18-19.

(3) Place the piston assembly in the retainer and, with a twisting motion, seat the piston in the bottom of the retainer.

(4) Position the clutch retainer over the piston retainer splines and support the assembly so the clutch retainer remains in place.

(5) Place the clutch piston spring and spacer ring on top of the piston in the clutch retainer. Make sure the spring and spacer ring are positioned in the retainer recess. Start one end of the wave spring into the retainer groove (figure 18-19), then progressively push or tap the spring into place. Make sure it is fully seated in the groove.

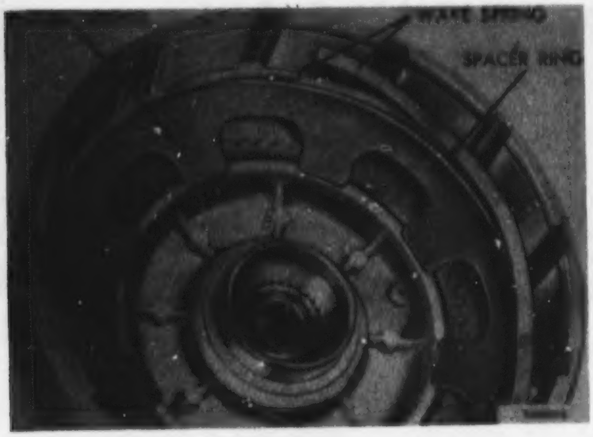


Figure 18-19. Installing Rear Clutch Spring, Spacer Ring, and Wave Spring.

(6) Install the inner pressure plate in the clutch retainer with the raised portion of the plate resting on the spring.

(7) Lubricate all clutch plates. Install one line plate followed by a steel plate until all plates are installed. Install the outer pressure plate and selective snap ring.

(8) Measure the rear clutch plate clearance by having an assistant press down firmly on the outer pressure plate. Then insert a feeler gage between the plate and the snap ring (figure 18-20). The clearance should be between 0.025 and 0.045 inch. If it is not, install a snap ring of proper thickness to get the specified clearance; low-limit clearance is desirable.

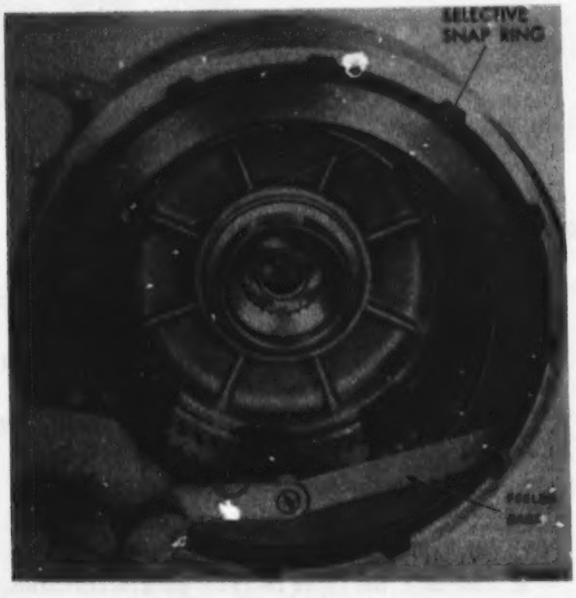


Figure 18-20. Measuring Rear Clutch Plate Clearance.

NOTE

Rear clutch plate clearance is very important in obtaining proper clutch operation. The clearance can be adjusted by using outer snap rings of various thicknesses. Snap rings are available in 0.060, 0.074, 0.088, and 0.106 inch thicknesses.

18-11. Planetary Gear Train.

a. End Play. Measure the end play of the planetary gear assemblies, the sun gear, and the driving shell before removing these parts from the output shaft. With the assembly in an upright position, push the rear annulus gear support down on the output shaft. Insert a feeler gage between the rear annulus gear support hub and the output shaft shoulder (figure 18-21). If the clearance is not 0.010 to 0.025 inch, replace the thrust washers or other necessary parts.

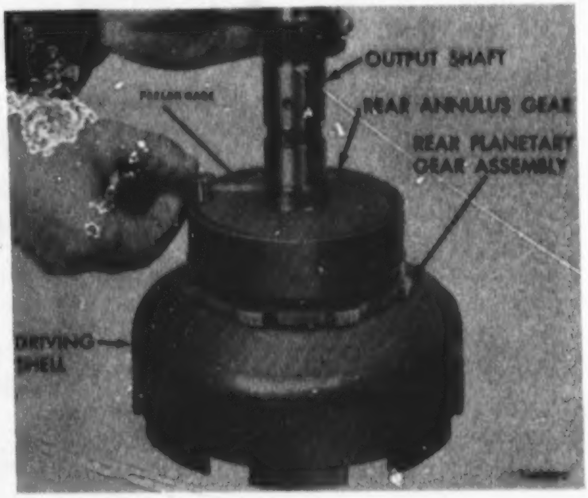


Figure 18-21. Measuring End Play of Planetary Gear Train.

b. Disassembly.

(1) Remove the thrust washer from the forward end of the output shaft (figure 18-22 for 4X2 models and figure 18-23 for 4X4 models).

(2) Remove the selective snap ring from the forward end of the output shaft. Slide the front planetary assembly off the shaft.

(3) Slide the front annulus gear off the planetary gear set. Remove the thrust washer from the rear side of the planetary gear set.

(4) Slide the sun gear, driving shell, and rear planetary assembly off the output shaft.

(5) Lift the sun gear and driving shell off the rear planetary gear assembly. Remove the thrust washers from inside the driving shell. Remove the snap ring and steel washer from the sun gear (rear side of the driving shell) and slide the sun gear out of the shell. Remove the front snap ring from

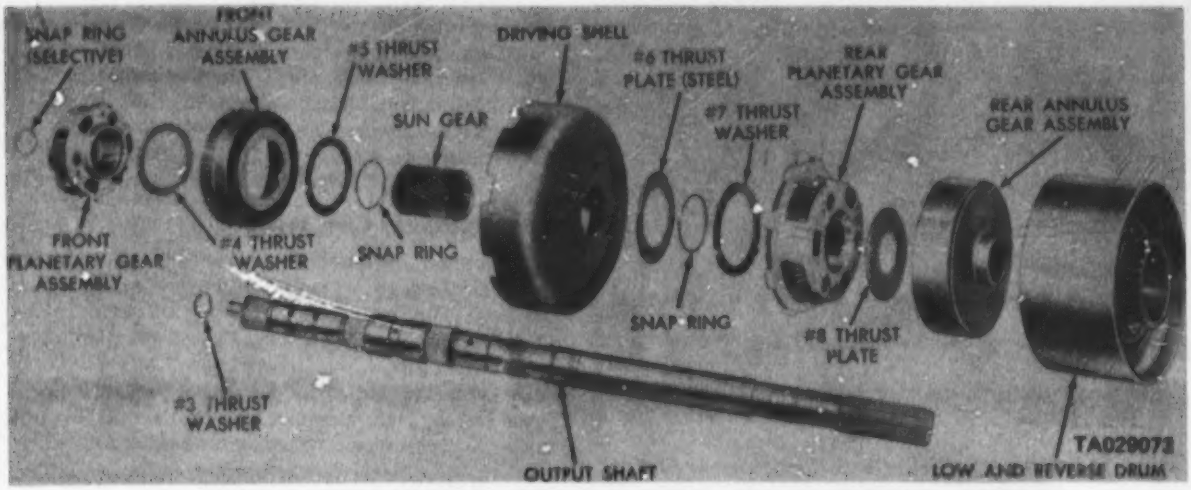

SNAP RING (SELECTIVE)
FRONT ANNULUS GEAR ASSEMBLY
#5 THRUST WASHER
DRIVING SHELL
#6 THRUST PLATE (STEEL)
REAR PLANETARY GEAR ASSEMBLY
#7 THRUST WASHER
REAR ANNULUS GEAR ASSEMBLY
SUN GEAR
FRONT PLANETARY GEAR ASSEMBLY
#4 THRUST WASHER
SNAP RING
SNAP RING
#8 THRUST PLATE
#3 THRUST WASHER
OUTPUT SHAFT
TA029073
LOW AND REVERSE DRUM

Figure 18-22. Planetary Gear Train and Output Shaft (4X2 Models).

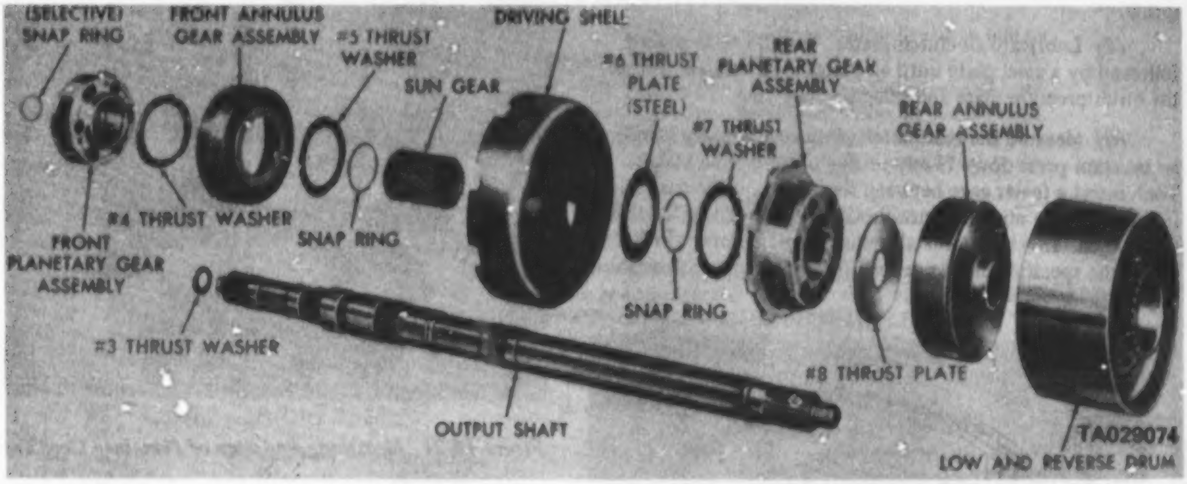

(SELECTIVE) SNAP RING
FRONT ANNULUS GEAR ASSEMBLY
#5 THRUST WASHER
SUN GEAR
DRIVING SHELL
#6 THRUST PLATE (STEEL)
REAR PLANETARY GEAR ASSEMBLY
#7 THRUST WASHER
REAR ANNULUS GEAR ASSEMBLY
#4 THRUST WASHER
SNAP RING
FRONT PLANETARY GEAR ASSEMBLY
SNAP RING
#3 THRUST WASHER
#8 THRUST PLATE
OUTPUT SHAFT
TA029074
LOW AND REVERSE DRUM

Figure 18-23. Planetary Gear Train and Output Shaft (4X4 Models).

the sun gear if necessary. Note that the front end of the sun gear is longer than the rear.

c. *Inspection Procedures.*

(1) Inspect the bearing surfaces on the output shaft for nicks, burrs, scores, or other damage. Light scratches, small nicks, or burrs can be removed with crocus cloth or a fine stone.

(2) Check the speedometer drive gear for any nicks or burrs. Remove them with a sharp-edged stone.

(3) Make sure all oil passages in the shaft are open and clean.

(4) Inspect the sun gear bushings for wear or scores. Replace the sun gear assembly if the bushings are damaged.

(5) Inspect all thrust washers for wear and scoring. Replace them if they are damaged or worn beyond the limits given in table 18-3.

(6) Check the planetary gear carrier thrust faces for wear, scores, or other damage. Replace as necessary.

(7) Check the planetary gear carrier for cracks. Look for worn or broken gear teeth on the pinion lockpins.

(8) Inspect the annulus gear and driving gear teeth for damage.

(9) Replace distorted lockrings.

d. *Assembly.* See figure 18-23 for parts identification.

(1) Install the rear annulus gear on the output shaft. Apply a thin coat of grease on the thrust plate. Place it on

Table 18-3. Thrust Washer Wear Limits

Reaction shaft support to front clutch retainer	#1 Selective 0.061" to 0.063" Natural 0.084" to 0.086" Red 0.102" to 0.104" Yellow
Front clutch to rear clutch	#2 0.061" to 0.063"
Input shaft to output shaft	#3 0.063" to 0.064"
Front annulus support to front carrier	#4 0.060" to 0.062"
Front annulus support to driving shell	#5 0.060" to 0.062"
■ Driving shell thrust plate	#6 0.034" to 0.036"
Rear carrier to driving shell	#7 0.060" to 0.062"
Rear annulus thrust plate	#8 0.034" to 0.036"

the shaft and in the annulus gear, making sure the teeth are over the shaft splines.

(2) Position the rear planetary gear assembly in the rear annulus gear. Place the thrust washer on the front side of the planetary gear assembly.

(3) Install a snap ring in the front groove of the sun gear (long end of the gear). Insert the sun gear through the front side of the driving shell. Install the rear steel washer and snap ring.

(4) Carefully slide the driving shell and sun gear assembly onto the output shaft, engaging the sun gear teeth with the rear planetary pinion teeth. Place the thrust washer inside the front driving shell.

(5) Place a thrust washer on the rear hub of the front planetary gear set. Slide the assembly into the front annulus gear.

(6) Carefully work the front planetary and annulus gear assembly on the output shaft, meshing the planetary pinions with the sun gear teeth.

(7) With all components properly positioned, install the selective snap ring on the front end of the output shaft. Remeasure the end play of the assembly.

NOTE

The clearance can be adjusted by using snap rings of various thicknesses. They are available in 0.048, 0.055, and 0.062 inch thicknesses.

18-12. Overrunning Clutch.

a. Inspection. See figure 18-24. Inspect the clutch rollers for smooth, round surfaces. They must be free of flat spots and chipped edges. Inspect the roller contacting surfaces in the cam and race for damage. Inspect the roller springs for distortion, wear, or other damage. Inspect the cam set screw for tightness. If loose, tighten and restake the case around the screw.

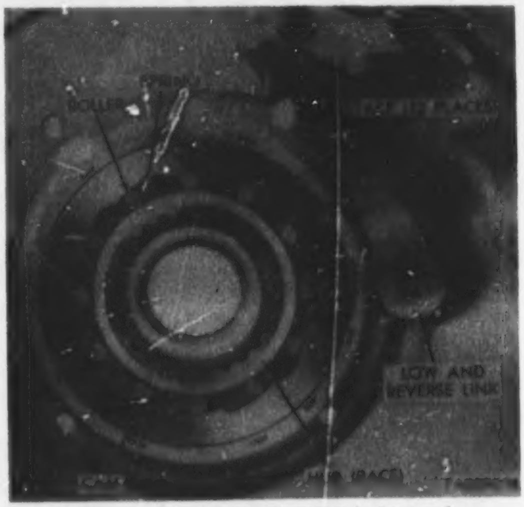


Figure 18-24. Overrunning Clutch, Low and Reverse Band Link.

b. Replacing the Overrunning Clutch Cam. If the overrunning clutch cam and/or roller spring retainer are found damaged, replace the cam and spring retainer as follows.

(1) Remove the set screw from the case below the clutch cam.

(2) Remove the four bolts securing the output shaft support to the rear of the transmission case. Insert a punch through the bolt holes and drive the cam from the case (figure 18-25). Alternate the punch from one bolt hole to another so the cam will be driven evenly from the case.

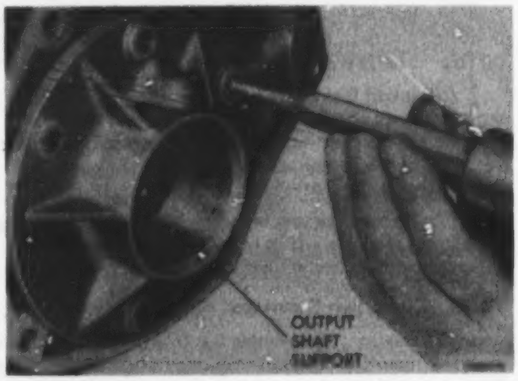


Figure 18-25. Removing Overrunning Clutch Cam.

NOTE

The output shaft support must be in the case to install the overrunning clutch cam. If the support requires replacement, drive it back out of the case with a wood block and hammer. To install, screw two C-3283-A pilot studs into the case (figure 18-26). Chill the support with ice (preferably dry ice). Quickly position the support over the pilot studs, and drive it firmly into the case with a wood block and hammer.

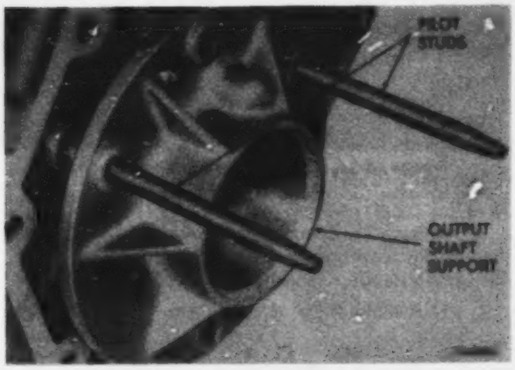


Figure 18-26. Installing Output Shaft Support.

(3) Clean all burrs and chips from the cam area in the case.

(4) Place the spring retainer on the cam, making sure the retainer lugs snap firmly into the notches.

(5) Position the cam in the case with the cam serrations alined with those in the case. Tap the cam evenly into the case, as far as possible, with a soft mallet.

(6) Install tool C-3863-A with adapter SP-5124 as shown in figure 18-27. Tighten the nut on the tool to seat the cam into the case. Make sure it is firmly bottomed, then install the cam retaining set screw. Stake the case around the set screw to prevent it from coming loose.

(7) Remove the cam installing tool. Install and tighten the support retaining screws to 140 in-lbs. Stake the case around the cam in twelve places with a blunt chisel.

18.13. Kickdown Servo and Band.

a. Disassembly. Disassemble the "controlled load" servo piston by removing the small snap ring from the servo piston. Then remove the washer, spring, and piston rod from the servo piston.

b. Inspection Procedures. Refer to figure 18-28 or 18-29, depending upon which servo is being serviced.

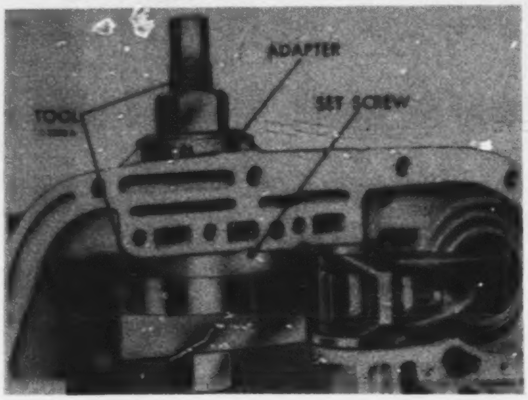


Figure 18-27. Installing Overrunning Clutch Cam.

(1) Inspect the piston and guide seal rings for wear. Make sure they turn freely in the grooves. Do not remove the seal rings unless they are damaged.

(2) Check the piston for nicks, burrs, scores, or wear. The piston plug must operate freely in the piston. Check the piston bore for damage. Check the fit of the guide on the piston rod, and check the piston spring for distortion.

(3) On "controlled load" servo pistons, always check the bore in the piston and the "O" ring on the piston rod.

(4) Check the band lining for wear. See if it is bonded to the band. Inspect the lining for black burn marks, glazing, non-uniform wear patterns, and flaking. If it is so worn that grooves are not visible at the ends or in any portion of the bands, replace the band. Replace bands that are distorted or have cracked ends.

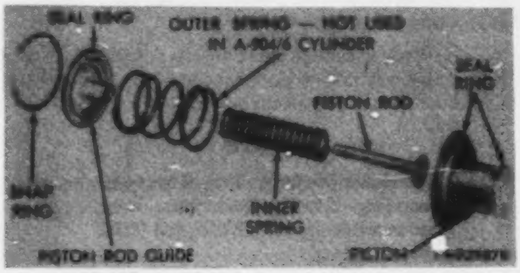


Figure 18-28. Kickdown Servo (Front Band).

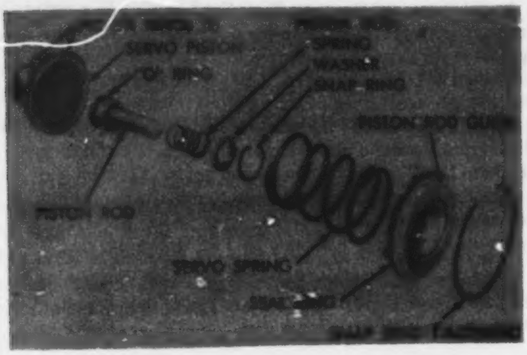


Figure 18-29. "Controlled Load" Kickdown Servo (Rear Band).

c. Assembly.

(1) Grease the "O" ring and install it on the piston rod.

(2) Install the piston rod into the servo piston.

(3) Install the spring, flat washer, and snap ring to complete the assembly.

18-14. Low-Reverse Servo and Band (Non-Controlled Load).

a. Disassembly. Remove the snap ring from the piston and remove the piston plug and spring (figure 18-30).

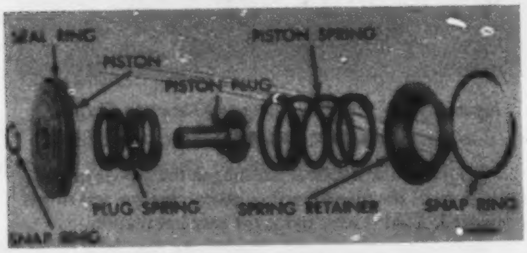


Figure 18-30. Low and Reverse Servo.

b. Inspection. Follow the inspection procedures given in paragraph 18-13.

c. Assembly. Lubricate and insert the piston plug and spring in the piston. Secure it with the snap ring.

18-15. Assembly-Subassembly Installation.

a. General. The assembly procedures given here include installation of the subassemblies in the transmission case and adjusting the drive train end play. Do not use force to assemble the mating parts. If parts do not assemble freely, investigate the cause and correct the trouble before proceeding with assembly procedures. Always use new gaskets during assembly operations. Use automatic transmission fluid to lubricate transmission parts during assembly.

b. Overrunning Clutch. With the transmission case in an upright position, insert the clutch hub inside the cam. Install the overrunning clutch rollers and springs exactly as shown in figure 18-24.

c. Low-Reverse Servo and Band.

(1) Carefully work the servo piston assembly into the case with a twisting motion. Place the spring, retainer, and snap ring over the piston (figure 18-30).

(2) Compress the low and reverse servo piston spring by using an engine valve spring compressor tool. Install the snap ring.

(3) Position the rear band in the case. Install the short strut, then connect the long link and anchor to the band (figure 18-31). Screw in the band adjuster just enough to hold the strut in place. Install the low-reverse drum. Be sure the long link and anchor assembly is installed as shown in the figure to provide running clearance for the low and reverse drum.

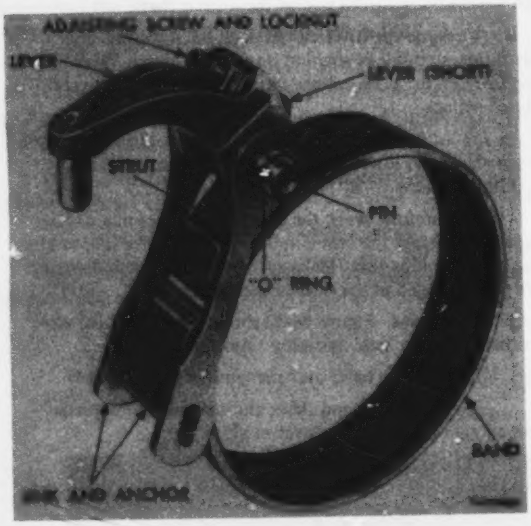


Figure 18-31. Low-Reverse Band and Linkage.

d. Kickdown Servo. Refer to figures 18-28 or 18-29.

(1) Subassemble the kickdown servo as follows:

(a) Grease the "O" ring and install it on the piston rod.

(b) Install the piston rod into the servo piston.

(c) Install the spring, flat washer, and snap ring to complete the subassembly.

(2) Carefully push the servo piston into the case bore. Install the piston rod springs and guide.

(3) Compress the kickdown servo springs by using an engine valve spring compressor tool. Install the snap ring.

e. Planetary Gear Assemblies, Sun Gear, and Driving Shell. While supporting the assembly in the case, insert the output shaft through the rear support. Carefully work the assembly back, engaging the rear planetary carrier lugs into the low reverse drum slots. Be very careful not to damage the ground surfaces on the output shaft during installation.

f. Front and Rear Clutch Assemblies. The front and rear clutches, front band, oil pump, and reaction shaft support are more easily installed with the transmission in an upright position. One method to support the transmission is outlined in steps *(1)* and *(2)*, below.

(1) Cut a 3-1/2-inch diameter hole in a bench, in the end of a small oil drum, or in a large wooden box strong enough to support the transmission. Cut or file the notches at the edge of the hole so the output shaft support will lay flat in the hole.

(2) Carefully insert the output shaft into the hole to support the transmission upright, with its weight resting on the flange of the output shaft support.

(3) Apply a coat of grease on the input to output shaft thrust washer (figures 18-22 and 18-23), and install the washer on the front end of the output shaft.

(4) Aline the front clutch plate inner splines, and place the assembly in position on the rear clutch. Make sure the front clutch plate splines are fully engaged on the rear clutch splines.

(5) Aline the rear clutch plate inner splines, grasp the input shaft, and lower the two clutch assemblies into the transmission case.

(6) Carefully work the clutch assemblies in a circular motion to engage the rear clutch splines over the splines of the front annulus gear. Make sure the front clutch drive lugs are fully engaged in the slots in the driving shell.

g. Front Band. Figure 18-32 shows a disassembled view of the kickdown band assembly. Assemble as follows:

(1) Slide the band over the front clutch assembly.

(2) Install the band strut, and screw in the adjuster just enough to anchor the strut in place.

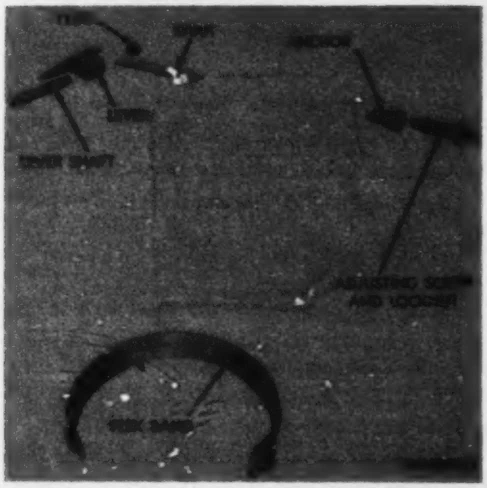


Figure 18-32. Kickdown Band and Linkage.

h. Oil Pump and Reaction Shaft Support. If it was difficult to remove the pump assembly due to an exceptionally tight fit in the case, you may need to expand the case with heat when installing the pump. Using a suitable heat lamp, heat the case around the pump for a few minutes prior to installing the pump and the reaction shaft support assembly. If the input shaft end play was not within specifications (0.036 to 0.082 inch) when measured before disassembly, replace the thrust washer on the reaction shaft support hub with one of the proper thickness (figure 18-9). Refer to thrust washer number 1 in table 18-3 for sizes available.

(1) Screw two pilot studs into the pump opening in the case (figure 18-33). Install a new gasket over the pilot studs.

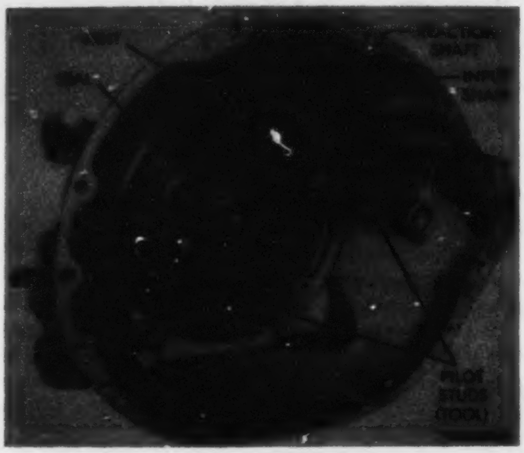


Figure 18-33. Installing Pump and Reaction Shaft Support Assembly.

(2) Place a new rubber seal ring in the groove on the outer flange of the pump housing. Make sure the seal ring is not twisted. Coat it with grease for easy installation.

(3) Install the pump assembly in the case. Tap it lightly with a soft mallet, if necessary. Install four pump body bolts. Remove the pilot studs, and install the remaining bolts snugly and evenly.

(4) Rotate the input and output shafts to see if any binding exists, then tighten the bolts to 175 in-lbs. Check the shafts again for free rotation. Adjust both bands.

i. Governor and Support.

(1) Position the support and governor body assembly on the output shaft. Aline the assembly so the governor shaft hole in the governor body alines with the hole in the output shaft. Then slide the assembly into place. Install the snap ring behind the governor body. Tighten the body-to-support bolts to 100 in-lbs. Bend the ends of the lock straps against the bolt heads.

(2) Place the governor valve on the valve shaft. Insert the assembly into the body and through the governor weights. Install the valve shaft retaining snap ring.

j. Extension Housing–Long.

(1) Install a snap ring in the front groove on the output shaft. Install the bearing on the shaft with its outer race ring groove toward the front. Press or tap the bearing tight against the front snap ring, then install the rear snap ring.

(2) Place a new extension housing gasket on the transmission case. Position the output shaft bearing retaining snap ring in the extension housing. Spread the snap ring as far as possible, then carefully tap the extension housing into place. Make sure the snap ring is fully seated in the bearing groove.

(3) Install and tighten the extension housing bolts to 24 ft-lbs.

(4) Install the basket and access plate on the side or bottom of the extension housing mounting pad.

(5) Install the speedometer pinion and the adapter assembly. Measure the input shaft end play, and correct it if necessary.

k. Extension housing (4x4 Models).

(1) Position gasket.

(2) Position the extension housing and bearing assembly.

(3) Install the extension housing-to-transmission bolts. Tighten to 24 ft-lbs.

l. Valve Body Assembly and Accumulator Piston.

(1) Clean the mating surfaces and look for burrs on both the transmission case and the valve body steel plate.

(2) Install the accumulator piston in the transmission case. Place the piston spring on the accumulator piston (figure 18-34).

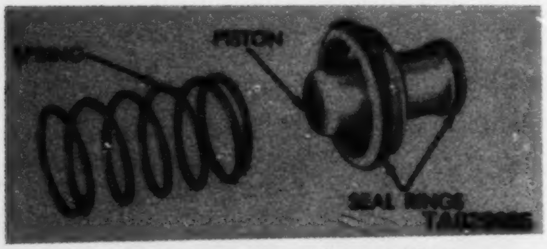


Figure 18-34. Accumulator Piston and Spring.

(3) Make sure the back-up light and neutral safety switch have been removed (paragraph 4-11).

(4) Insert the parking lock rod through the opening in the rear of the case with the knob positioned against the reaction plug and sprag. Move the front end of the rod toward the center of the transmission while pressing back on the rod to force it past the sprag (rotate the output shaft if necessary).

(5) Place the valve body manual lever in the low position. Place the valve body in its approximate position in the case. Connect the parking lock rod to the manual lever and secure it with an "E" clip. Aline the valve body in the case, and install the retaining bolts finger-tight.

(6) With the neutral safety switch installed (paragraph 4-11), place the manual valve in the neutral position. Shift the valve body if necessary to center the neutral finger over the neutral switch plunger. Snug the bolts down evenly, then tighten them to 100 in-lbs.

(7) Install the gearshift lever and tighten the clamp bolt. Check the lever shaft for binding in the case by moving the lever through all detent positions. If binding exists, loosen the valve body bolts and re-aline them.

(8) Install the flat washer and throttle lever, then tighten the lever clamp bolt.

(9) Adjust the kickdown and low-reverse bands.

(10) Install the oil pan, using a new gasket. Tighten the pan bolts to 150 in-lbs.

CHAPTER 19

REPAIR OF THE REAR DIFFERENTIAL ASSEMBLY

19-1. Servicing the Differential.

a. Removal and Disassembly.

(1) Remove the axle shaft (see TM 9-2320-266-20).

(2) Position the carrier and tube assembly in a vise or a suitable holding device with the carrier cover facing upward. Thoroughly clean the outer area of the carrier and tube with cleaning solvent. Blow dry with compressed air.

(3) Loosen and remove the cover screws and remove the carrier cover. Tilt the assembly and drain the lubricant into a container.

(4) Use a cleaning solvent to wash and clean the differential, bearings, gear ring and pinion, and internal surfaces. Blow them dry with compressed air.

(5) Mount a dial indicator on a pilot stud (figure 19-1) to measure the drive gear back face runout. Load the indicator stem slightly with the plunger at right angles to the back face of the drive gear.

NOTE

If side play was found during inspection, runout can't be measured accurately. Adjust the side play.

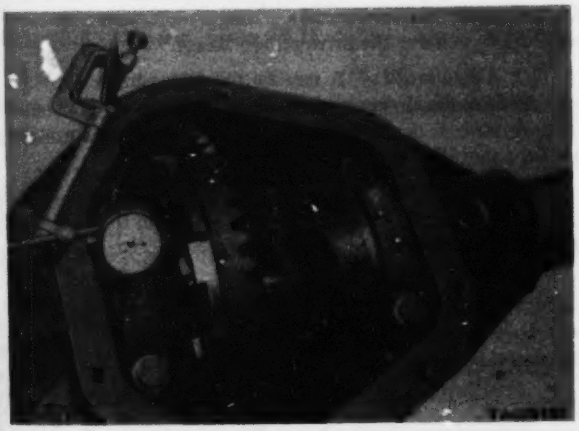


Figure 19-1. Measuring Drive Gear Runout.

(6) Measure the drive gear back face runout by rotating the drive gear several complete revolutions and reading the dial indicator. Mark the drive gear and differential case at the point of maximum runout. (The markings will be very helpful later in checking the differential case runout). If the total indicator readings are above 0.006 inch, it may mean a loose drive gear or a damaged differential case.

(7) Check the clearance between the differential bearing cap and the bearing cup by trying to insert a 0.003 inch feeler gage between them. A 0.003-inch feeler gage should not be able to enter between the bearing cap and the cup. If it does, the bearing cup may have turned in the carrier, causing excessive wear.

(8) Note the identifying letters stamped on the bearing caps and the face of the carrier housing seal surface (figure 19-2). Letters stamped on the left side are in a horizontal position while those on the right side are in a vertical position. Always match the identifying letters for proper reassembly.

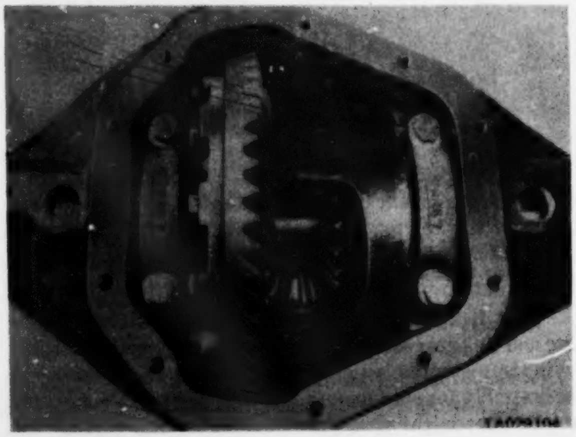
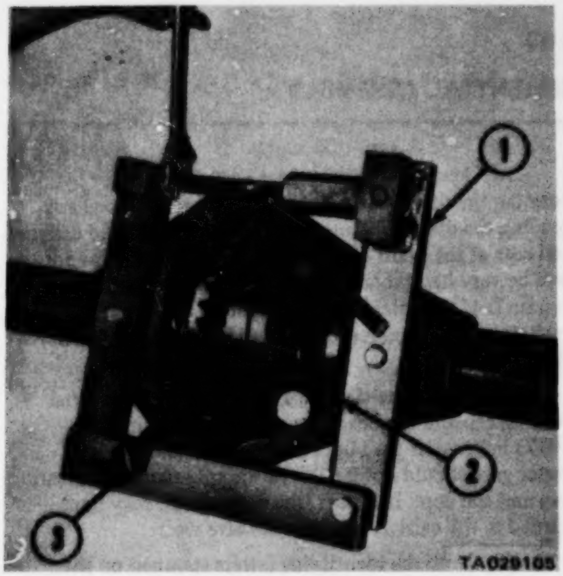


Figure 19-2. Bearing Cap Identification.

(9) Loosen and remove the differential bearing caps and locate spreader tool W-129-A with the tool dowel pins seated in the locating holes of the axle housing (figure 19-3). Turn the tool screw finger-tight at this time.

(10) Install the pilot stud on the left side of the axle housing. Attach the dial indicator and load the indicator stem slightly against the opposite side of the axle housing (figure 19-3).



Legend for Figure 19-3:

1. Spreader W-129-A
2. Dial indicator and pointer
3. Dial indicator clamp

Figure 19-3. Spreading Rear Axle Housing.

CAUTION

Do not spread the housing over 0.020 inch, as it will result in permanent damage to the carrier casting.

(11) Tighten the spreader tool nut until you get a 0.015-inch movement of the dial indicator, allowing you to remove the differential case and ring assembly. Press down on the opposite side of the spreader while applying torque; this prevents the tool from popping off.

(12) Remove the dial indicator and the differential case and ring gear assembly from the axle housing. A light prying action with a screwdriver or pinch bar will loosen the assembly for easy removal. Pry the differential case and ring gear as straight up as possible using leverage against the differential case and carrier to prevent damage. Keep the respective bearing cones if they are not worn or damaged, and are to be reused.

(13) Place the differential case between the soft jaws of a vise and remove and discard the drive gear screws. Using a fiber mallet, tap the drive gear loose from the differential case pilot and remove it.

(14) If the drive gear runout was over 0.006 inch in step 5, remeasure the differential case flange runout. Install the differential case with its respective bearing cups in the axle housing. Loosen the spreader tool nut and remove it. Install the bearing caps and tighten them snugly. Install the dial indicator as shown in figure 19-4, and measure the runout as described in step 5.

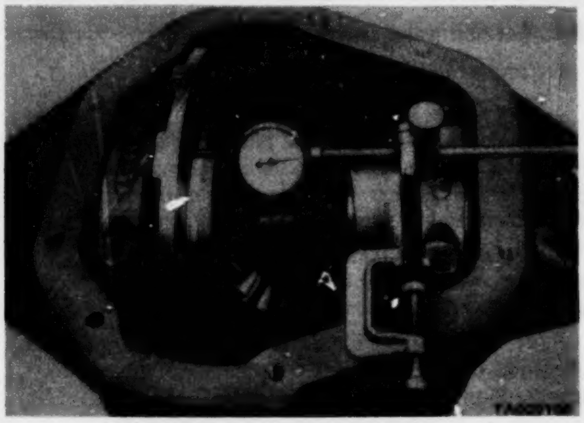


Figure 19-4. Measuring Differential Case Drive Gear Mounting Flange Face Runout.

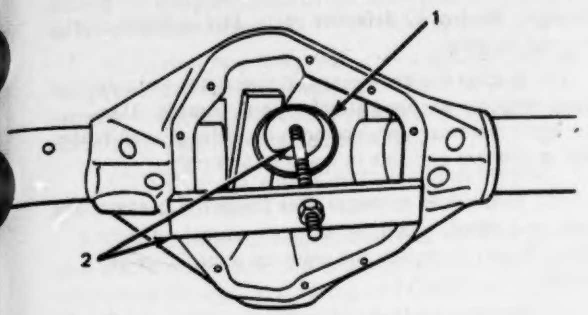
(15) The total allowable runout is 0.003 inch. If runout is excessive, try positioning the drive gear 180 degrees from the point of maximum runout when reassembling the ring gear on the differential case. Repeat steps 8, 9, 10, and 11 above, to see if runout is now 0.003 inch or less.

(16) Position the carrier and tube assembly in the vise with the nose of the carrier in an upward position. Remove the drive pinion nut and washer. Using a puller and holding tool C-3281, remove the drive pinion flange.

(17) Using tool C-748, remove the drive pinion oil seal. Remove the slinger, gasket, front pinion bearing cone and preload shim pack. Record the thickness of the shims in case they should be lost.

(18) Position the carrier and tube assembly on an arbor press. Press out the drive pinion stem and the rear bearing cone assembly.

(19) Using tool W-100-44-60, remove the front and rear pinion bearing cup (figures 19-5 and 19-6). Remove and record the thickness of the shim pack from behind the rear pinion bearing cup.

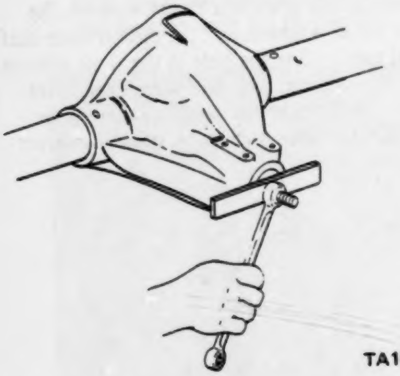


Legend for Figure 19-5:

TA180932

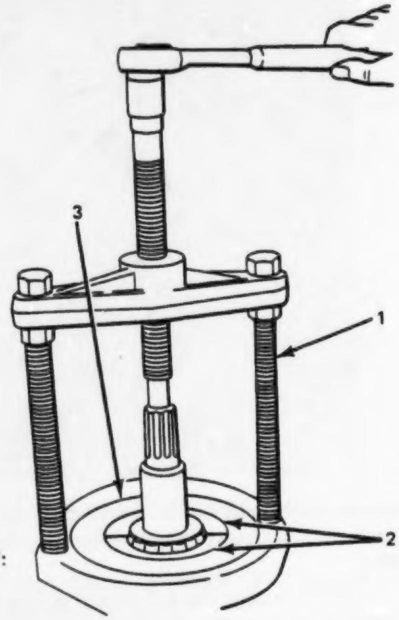
1. Bearing cup
2. Tool W-100-44-60

Figure 19-5. Pinion Inner Bearing Cup Removal.



TA180933

Figure 19-6. Pinion Outer Bearing Cup Removal.

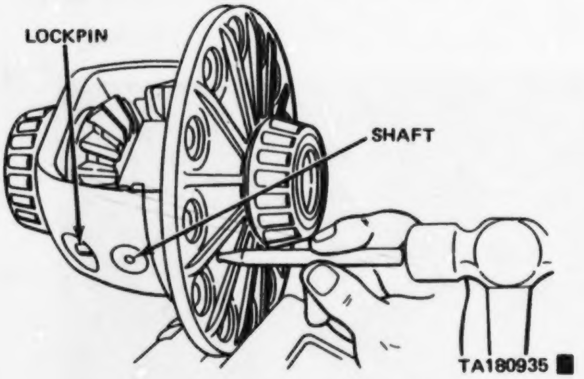


Legend for Figure 19-7:

1. Puller DD-914-P
2. Adapter C-293-37
3. Holding ring DD-914-8

TA180934

Figure 19-7. Removing Rear Bearing Cone.



TA180935

Figure 19-8. Removing Differential Pinion Shaft Lockpin (Typical).

(20) Remove the rear bearing cone from the drive pinion stem using tool DD-914-P, adapter ring DD-914-8, and C-293-37 adapters (figure 19-7).

(21) Place the differential case in a vise equipped with soft jaws. Drive out the lockpin securing the differential pinion shaft to the case (figure 19-8).

(22) Remove the differential pinion mate shaft, the differential pinion mates, and the thrust washers (one in back of each pinion). Remove the differential side gears and thrust washers (one in back of each gear).

(23) Remove the differential case from the vise. Using tool DD-914-P and DD-914-62 puller plates, remove the differential cones from the case (figure 19-9). Make sure the bearing remover adapters are located where they won't pull on the bearing cage.

(24) Remove the shims located behind each bearing and record the thickness and the respective side to aid in positioning them during reassembly.

b. Cleaning and Inspecting the Differential.

(1) Wash and clean all parts in a suitable cleaning solvent and, with the exception of the bearing cones, dry them with compressed air. To clean the axle housing tubes, insert a stiff wire into the tube, attach a clean cloth to the wire at the center section, and withdraw it from the center outward. Do not steam clean. Figure 19-10 shows a disassembled view of the differential assembly.

(2) All machined contact surfaces in the axle housing and differential bearing caps should be smooth and free of any raised edges. Front and rear pinion bearing cup bore machine surfaces should be smooth. Remove the raised metal on the shoulders of the bores (incurred when removing the cups) with a hand stone.

(3) The differential bearings and the front and rear pinion bearing cone and cup assemblies should have a smooth appearance with no broken or dented surfaces on the rollers or the roller contact surfaces. The bearing roller

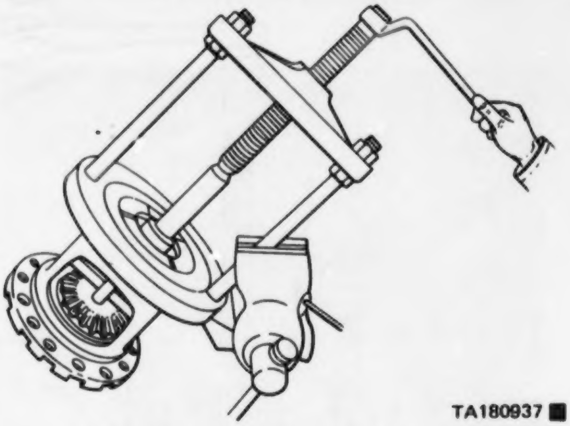


Figure 19-9. Removing Differential Bearings.

retainer cages must not be distorted or cracked. When replacing the bearings, always replace the cup and cone in a set.

(4) Examine the differential pinion mate shaft, the pinion mates, the side gears, and the thrust washers for wear or damage. Replace all defective parts. Pinion mates must be replaced in sets.

(5) Inspect the drive gear and pinion for worn or chipped teeth, or damaged attaching-bolt threads. If replacement is necessary, replace both the drive gear and drive pinion as they are available in matched sets only.

(6) Inspect the universal joint flange for cracks, worn splines, or a pitted, rough, or corroded oil seal contacting surface. Repair or replace the universal joint flange as necessary.

(7) Inspect the drive pinion bearing shim pack for broken, damaged, or distorted shims. Replace, if necessary, when you establish the pinion bearing preload.

c. Assembly and Installation.

(1) Lubricate all parts with differential lubricant. Install the differential side gears and thrust washers, the pinion mates and thrust washers, and the pinion mate shaft in the differential case. Aline the hole in the shaft with the hole in the case. Drive in the lockpin. If new gears and washers are used, it will not be necessary to check gear backlash; close manufacturing tolerances insure a correct

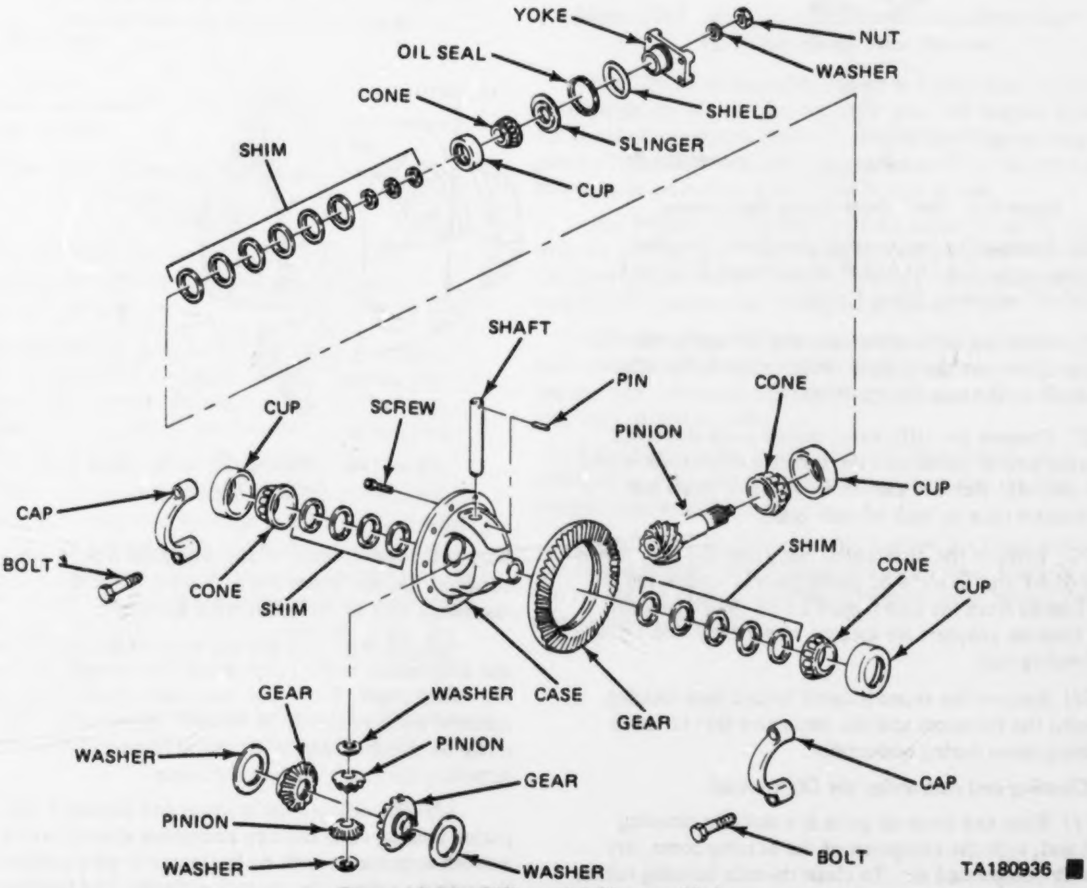

YOKE
NUT
OIL SEAL
WASHER
CONE
SHIELD
SLINGER
SHIM
CUP
SHAFT
PIN
CONE
PINION
CUP
SCREW
CUP
CAP
BOLT
CONE
SHIM
SHIM
CONE
CUP
GEAR
WASHER
CASE
GEAR
WASHER
PINION
GEAR
CAP
PINION
BOLT
WASHER
WASHER
TA180936

Figure 19-10. Differential Disassembled.

fit. Position the drive gear on the differential case pilot. alining the threaded holes of the drive gear with hose in the differential case flange.

(2) Insert new drive gear screws through the case flange and into the drive gear. After all capscrews are properly started, tap the drive gear against the differential case flange with a non-metallic mallet.

(3) Clamp the unit between the brass jaws of a vise and alternately tighten each capscrew to 110-115 ft-lbs.

(4) Position each differential bearing cone on the hub of the differential case (without shims), with the small end away from the drive gear, using tool C-4025-A (figure 19-11). An arbor press may be used in conjunction with the installing tool.

CAUTION

Never exert pressure against the bearing cage, since this will damage the bearing and make it unfit for further use.

Figure 19-11. Installing Differential Bearing Cones.

(5) Position the differential bearing cups on their respective cones and insert the differential case in the carrier. Install the bearing caps in their correct positions. Tighten the bearing cap bolts finger-tight.

(6) Install the dial indicator fixture with the indicator pointer contacting the back face of the drive gear.

(7) Insert a screwdriver blade between the bearing cup and housing, and pry the case assembly as far as possible to one side of housing (figure 19-12). Set the dial indicator at zero. Using a screwdriver, pry the case to the opposite side of the housing and record the reading. This reading indicates the amount of shims needed to take up the clearance between the differential bearing cups and the case. The shim pack thickness to be placed on the bearing hub between the bearing cone and the differential case will be calculated later in the procedure after you install the drive pinion and determine depth of mesh setting.

(8) Remove the dial indicator, loosen the bearing cap bolts and remove the bearing caps. Remove the differential assembly from the housing.

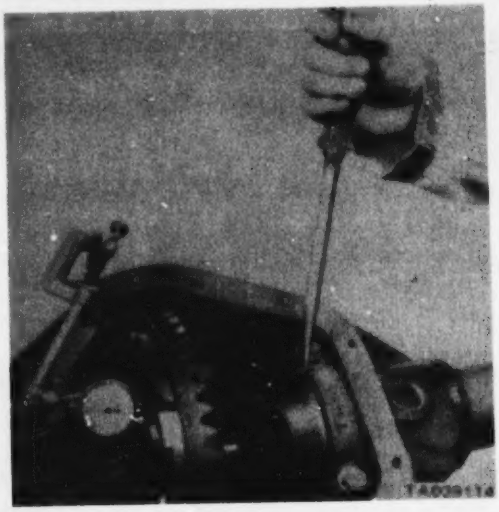


Figure 19-12. Determining Shims to Obtain "0" End Clearance.

19-2. Drive Pinion Depth of Mesh Setting and Pinion Bearing Preload.

Use tool set C-758-44-60 (figure 19-13) to install the drive pinion bearing cups, and to determine the pinion depth of mesh as follows:

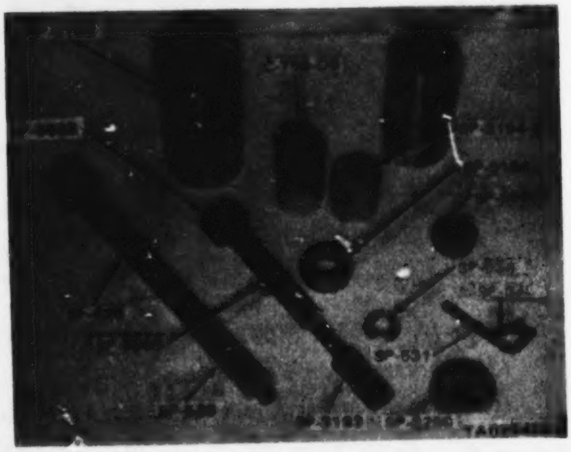


Figure 19-13. Tool Set C-758-44-60.

a. Installing Bearing Cups.

(1) Position the drive pinion cups into the axle housing.

(2) Install adapter SP-5184 on shaft SP-526. Then install the rear pinion bearing cone (figure 19-14).

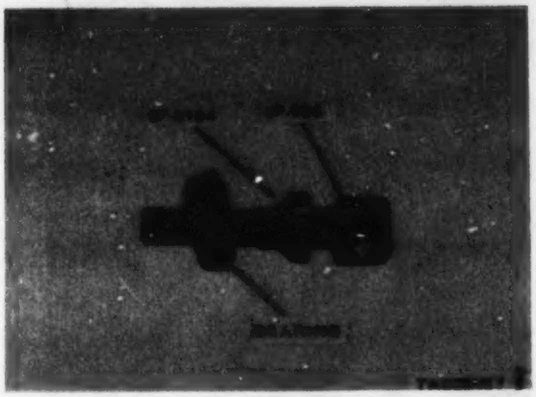


Figure 19-14. Installing the Rear Pinion Bearing Cone.

(3) Position the tool and rear bearing in the axle housing.

(4) Install the front bearing cone and adapters SP-534-B, SP-534, and SP-533 on tool SP-526 as shown in figure 19-15.

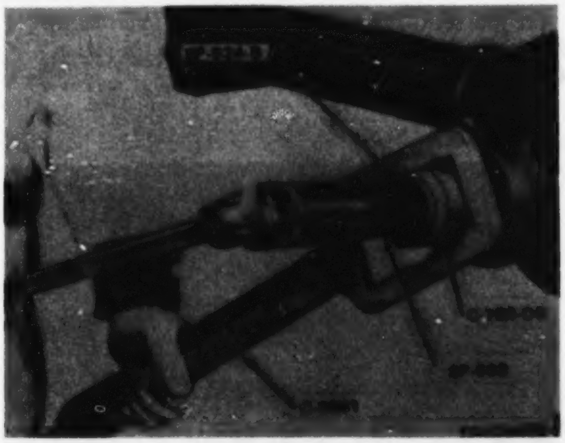


Figure 19-15. Seating Bearing Cups in Axle Housing.

(5) Lubricate the drive pinion bearing cones.

(6) Hold the compression sleeve with tool C-328 and tighten the compression nut until the cups are seated. Refer to figure 19-15, above.

NOTE

Turn the tool several times while tightening, so the bearing rollers will aline in the cups and prevent damage.

(7) After the bearings are seated, loosen the compression nut. Retighten the nut to produce 10-30 in-lbs of preload (figure 19-16).

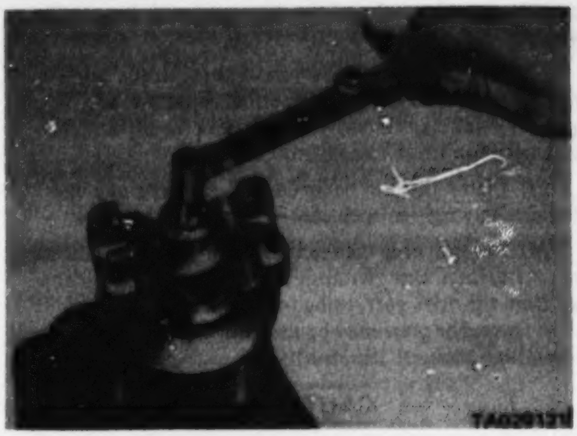


Figure 19-16. Checking Pinion Bearing Preload.

b. Determining Depth of Mesh and Preload.

(1) With pinion tool SP-526 in place, attach adapter SP-3250 with a cap screw and tighten securely.

(2) Center adapter SP-5183 in the axle housing.

(3) Install the differential bearing caps. Torque the bolts to 10 ft-lbs.

(4) Use a feeler gage to select the proper thickness of shims that will fit snugly between adaptors SP-5183 and SP-3250 (figure 19-17).

NOTE

This measurement will determine the correct thickness shim pack for installation behind the rear pinion bearing cup and the carrier casting.

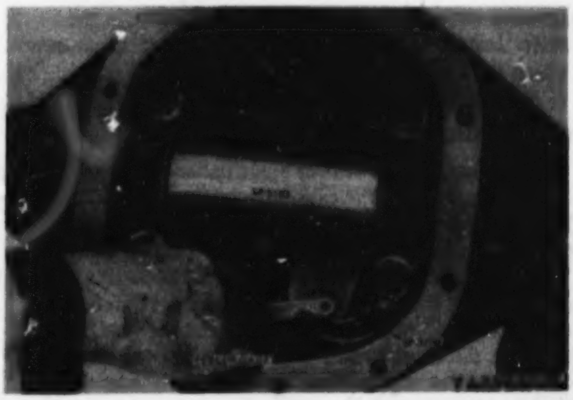


Figure 19-17. Determining Shim Pack Thickness for Drive Pinion Depth of Mesh.

(5) To select a shim pack, read the markings on the end of the pinion head as shown in figure 19-18. One number is found on both the drive pinion and the ring, which indicates a matched gear set. Directly opposite this number will be one with a "+" or "-" before it, or the number will be "0." This number must be positively identified before continuing the assembly procedure. Midway between the two sets of numbers described above are numbers and letters which are etched for manufacturing purposes only. But as one of these numbers may be "0," it might be confused with the number needed for the assembly procedure. A rule to follow would be to first examine the shaft end for a positive or negative number. If a positive or negative number is not etched on the pinion head, then the number will be zero (see table 19-1).

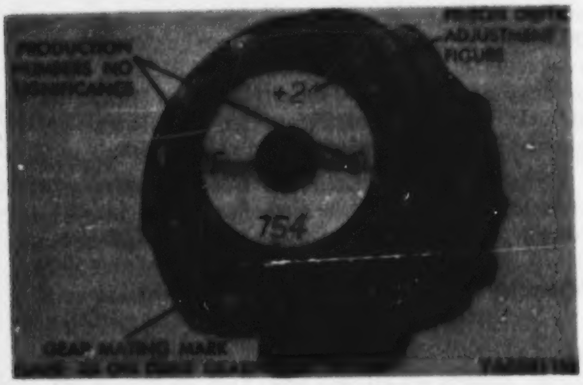


Figure 19-18. Drive Pinion Markings.

(6) If the marking is negative, add the correct amount of shims. If the marking is positive, subtract the correct amount of shims. Shims are available in 0.003, 0.005, and 0.010 inch thicknesses.

(7) Remove the tool and adapters from the axle housing.

(8) Remove the rear pinion bearing cup and install the correct shim pack.

(9) Reinstall the rear bearing cup as described in a, above.

(10) Lubricate the cone, and install it on the pinion shaft using tool C-3095-A. Refer to figure 19-19.

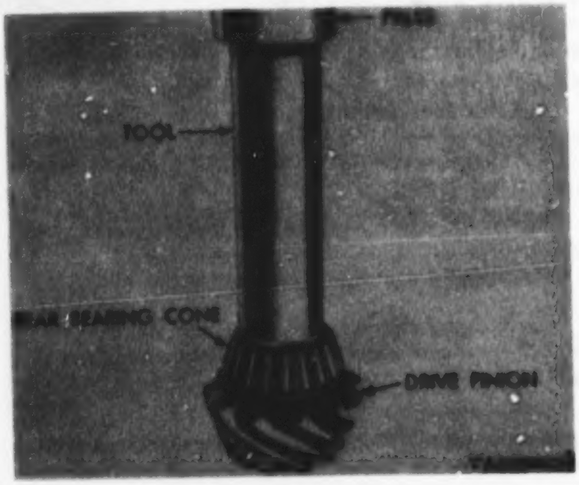


Figure 19-19. Installing the Rear Pinion Bearing Cone.

Table 19-1. Pinion Setting Chart

Old Pinion Marking	New Pinion Marking								
	-4	-3	-2	-1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	-0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	-0.001	-0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	-0.001	-0.002	-0.003
0	+0.004	+0.003	+0.002	+0.001	0	-0.001	-0.002	-0.003	-0.004
-1	+0.003	+0.002	+0.001	0	-0.001	-0.002	-0.003	-0.004	-0.005
-2	+0.002	+0.001	0	-0.001	-0.002	-0.003	-0.004	-0.005	-0.006
-3	+0.001	0	-0.001	-0.002	-0.003	-0.004	-0.005	-0.006	-0.007
-4	0	-0.001	-0.002	-0.003	-0.004	-0.005	-0.006	-0.007	-0.008

CAUTION

To prevent damage to the bearing, do not strike the bearing cage during installation.

(11) Install the drive pinion and bearing assembly in the carrier.

(12) Install the original front bearing shim pack followed by the front bearing cone.

(13) Install the companion flange and nut. Tighten the nut to 200-220 ft-lbs.

(14) To check torque, rotate the pinion shaft with an inch-pound torque wrench. The drive pinion must be vertical for this check. The torque reading to start the shaft turning will be disregarded. The torque reading while rotating the shaft should be 20-40 in-lbs with new bearings, or 10-20 in-lbs if the old bearings were used.

(15) Add or remove shims from behind the front bearing cone to obtain the correct (bearing preload) turning torque. Shims are available in the following thicknesses: 0.003, 0.005, 0.010, and 0.030 inch.

(16) After the correct bearing preload has been established, pinion setting depth should be rechecked.

(17) Remove the companion flange and nut.

(18) Install the oil slinger and gasket. Install a new oil seal. If the dust shield has been removed, install a new dust shield.

(19) Install the companion flange, washer, and nut. Tighten the nut to 250-270 ft-lbs, holding the flange with tool C-3281.

(20) Turn the carrier and tube assembly in the holding fixture with the cover side facing upward. Install the axle shaft inner oil seals.

19-3. (Deleted.)

19-4. Differential Bearing Preload and Drive Gear and Pinion Backlash.

a. With the drive pinion and bearings installed and the bearing preload set, install the differential case and ring gear assembly with their respective bearing cups. Install the bearing caps in their positions, aline identification marks, and tighten the cap bolts finger-tight. Refer to the measurement taken previously in step 7 of paragraph 19-1*c*. This reading, taken before the drive pinion was installed, represents the total clearance between the differential bearing cups and the carrier casting. Perform the following steps to determine the shim thicknesses required behind each bearing cone to take up the clearance and establish the correct bearing preload and backlash.

b. Install a dial indicator and position the contact point against the back face of the ring gear. Move the differential and ring gear assembly tight against the drive pinion. Set the dial indicator on zero. Move the differential and ring gear assembly in the opposite direction as far away from the pinion as possible, and note the reading on the dial indicator. This reading represents the shim pack thickness necessary to take up the clearance between the bearing cup and the case on the ring gear side of the differential assembly. Subtract this reading from the previously recorded total reading to obtain the amount of shims necessary to take up the clearance between the bearing cup and the case at the pinion side of the differential.

c. Remove the differential and ring gear assembly from the carrier.

d. Remove the differential bearing cones. Install the correct thickness shim pack, determined in step *b*, between the bearing cone and the differential case hub shoulder using tool C-4025-A. Add an additional 0.015 inch shim to the drive gear tooth side of the differential and install the differential bearing cones. This additional 0.015 shim pack provides the correct bearing preload and backlash.

e. Position spreader tool W-129-A in the locating holes of the carrier and tighten the screw finger-tight. Install the dial indicator and spread the carrier 0.015 to 0.020 inch. Do not exceed this limit, or you won't be able to place the differential and ring gear assembly in the carrier.

f. Install the bearing caps in their respective positions as indicated by the identification marks on the caps and carrier. Remove the spreader tool. Coat the bearing cap bolt threads with sealing compound and install and tighten the bolts snugly.

g. Tap the drive gear lightly with a rawhide hammer to properly seat the differential bearing and cups. Take care to prevent nicking the teeth of the ring gear or drive pinion as they are meshed together. Tighten the bearing cap bolts to 70-90 ft-lbs.

h. Attach a dial indicator to the carrier. With the indicator contact point contacting the ring gear tooth (figure 19-20), measure the backlash between the ring gear and drive pinion.

i. Check the backlash at four equally spaced points around the circumference of the ring gear. The backlash must be held between 0.004 and 0.009 inch, and cannot vary more than 0.002 inch between the four positions checked. If backlash does not fall within these specifications, change the shim pack thickness on both differential bearing hubs to maintain proper bearing preload and backlash.

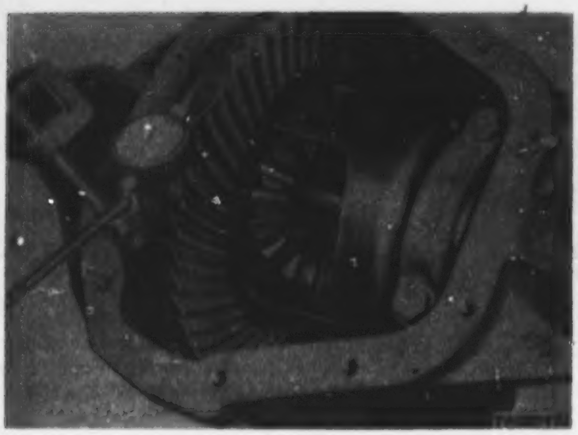


Figure 19-20. Checking Backlash Between Drive Gear and Pinion.

19-5. Gear Tooth Contact Pattern.

a. Apply a thin coat of hydrated ferric oxide, commonly known as yellow oxide of iron, or equivalent, to both the drive and coast side of the drive gear teeth. Rotate the drive gear one complete revolution in both directions while the load is being applied. Apply the load with a round bar or screwdriver between the carrier casting and the differential case flange. This action will leave a distinct contact pattern on both the drive and coast side of the drive gear teeth. The gear tooth contact pattern will disclose whether the correct rear pinion bearing mounting shim has been installed and the drive gear backlash set properly. Backlash between the drive gear and pinion must be maintained within the specified limits until the correct tooth contact pattern is obtained.

b. Observe the contact pattern on the drive gear teeth and compare it with those in figures 19-21, 19-22, and 19-23, to determine if the pattern is properly located. With the pinion depth of mesh and gear backlash set properly, your contact pattern should resemble that in figure 19-21. Notice that the correct contact pattern is well centered on both drive and coast sides of the teeth. When tooth contact patterns are obtained by hand, they are apt to be rather small. Under the actual operating load, however, the contact area increases.

c. If after observing the contact pattern you find it resembles that in figure 19-22, the drive pinion is too far away from the centerline of the ring gear. The contact pattern will appear high on the heel on the drive side and high on the toe on the coast side. To correct this type of tooth contact pattern, increase the thickness of the shim pack located behind the rear pinion bearing cup (figure 19-23). This will cause the high heel contact on the drive side to lower and move toward the toe; high toe contact on the coast side will lower and move toward the heel.

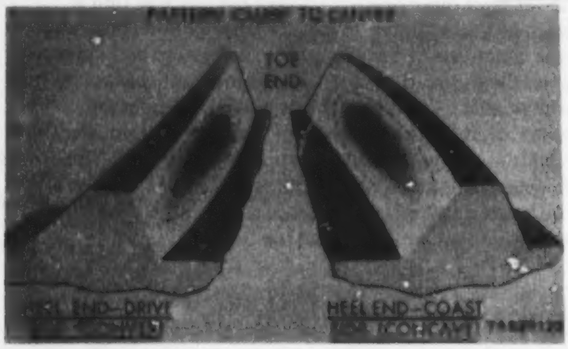


Figure 19-21. Desired Tooth Contact Under Light Load.

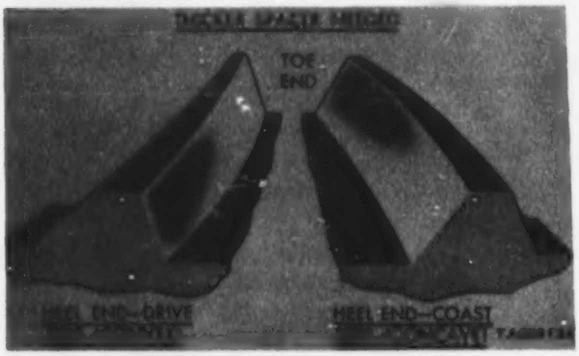


Figure 19-22. Incorrect Tooth Contact Pattern (Increase Shim Pack Thickness).

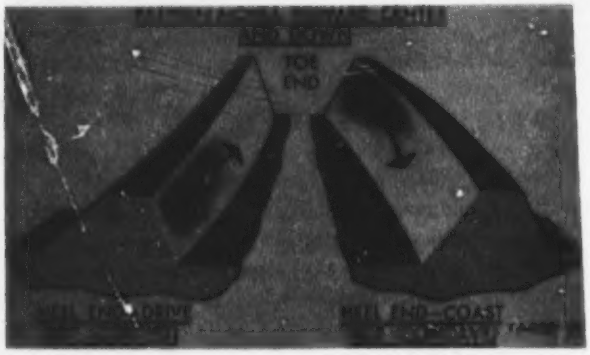


Figure 19-23. Effect on Tooth Contact Pattern as Shim Pack Thickness is Increased.

d. If after observing the contact pattern you find it resembles that in figure 19-24, the drive pinion is too close to the centerline of the ring gear. The pattern will appear low on the toe on the drive side and low heel contact on the coast side. To correct this type of tooth contact pattern, decrease the thickness of the shim pack located behind the rear pinion bearing cup (figure 19-25). This will cause the low toe contact on the drive side to raise and move toward the heel; low heel contact on the coast side will raise and move toward the toe.

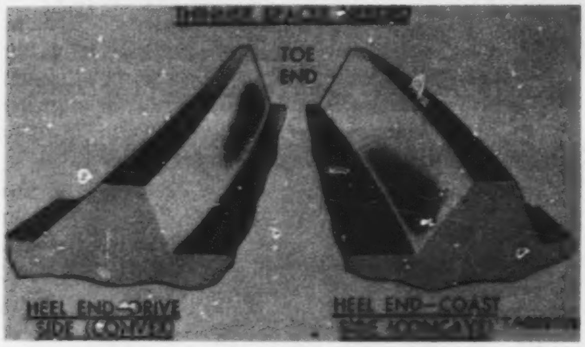

THINNER SPACER NEEDED
TOE END
HEEL END—DRIVE SIDE (CONVEX)
HEEL END—COAST SIDE (CONCAVE)

Figure 19-24. Incorrect Tooth Contact Pattern (Decrease Shim Pack Thickness).

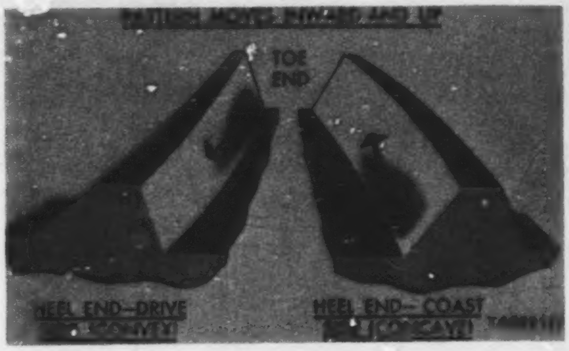

PATTERN MOVES INWARD AND UP
TOE END
HEEL END—DRIVE SIDE (CONVEX)
HEEL END—COAST SIDE (CONCAVE)

Figure 19-25. Effect on Tooth Contact Pattern as Shim Pack Thickness is Decreased.

CHAPTER 20

REPAIR OF THE FRONT DIFFERENTIAL ASSEMBLY

20-1. Differential Case and Drive Pinion.

A close examination of the axle assembly can often reveal valuable information as to the extent and type of repairs or adjustments necessary. Since the most frequent causes of axle noise are improper backlash, differential bearing preload, or both, a few simple adjustments may be all that is necessary to correct the deficiency. Therefore, before disassembling the differential assembly, make the following checks: drive gear and pinion backlash (paragraph 20-3), pinion bearing preload (paragraph 20-2), and tooth contact pattern (paragraph 20-4). Record and analyze the results. These measurements will aid you in making the necessary repairs to the axle assembly.

a. Removal and Disassembly. If after the above tests and adjustments the deficiency is not corrected, then proceed as follows:

(1) Remove the front axle assembly from the truck (see chapter 6). Place the carrier and tube assembly on a holding fixture with the carrier cover opening facing upward.

(2) Thoroughly clean the differential gears, bearings, and other internal parts with a suitable solvent.

(3) Install a dial indicator (figure 20-1), and check the back face of the drive gear for runout. A reading in excess of 0.006 inch might indicate a loose drive gear or a sprung differential case.

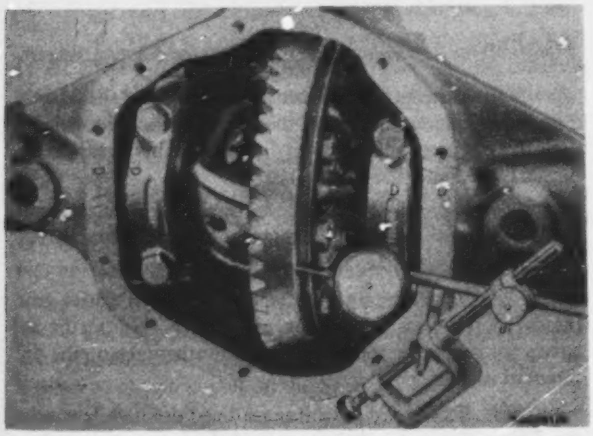


Figure 20-1. Checking Drive Gear Runout.

(4) Check the clearance between the differential bearing cap and the bearing cup by prying against the drive gear with a feeler gage. A 0.003-inch feeler gage should not be able to enter between the bearing cap and cup. If it does, the bearing cup may have turned in the carrier, causing excessive wear.

(5) Turn the gear carrier and tube assembly in the holding fixture so that the drive pinion shaft is vertical.

(6) Remove the nut from the drive pinion shaft, holding the companion flange with tool C-3281 (figure 20-2).

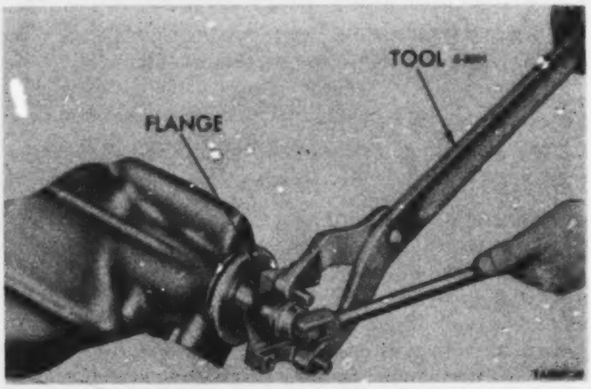


Figure 20-2. Removing or Installing Companion Flange Nut.

(7) Remove the companion flange (figure 20-3).

(8) Remove the drive pinion seal assembly.

(9) Turn the gear carrier and tube assembly in the holding fixture. Remove the differential bearing cups. Note the matching marks on the carrier and bearing caps (figure 20-4).

(10) Install carrier spreader tool W-129-A, with the dowels completely engaged, to full depth in the holes provided in the housing (figure 20-5). Be sure two hold-down clamps are properly and firmly holding the spreader in position.

(11) Install a long stud in the carrier cover bolt hole on the left side of the housing. Install a dial indicator and fixture, and position the indicator pointer on the opposite side of the housing (figure 20-5).

(12) Spread the carrier until a 0.015 to 0.020 inch spread is shown on the indicator. Do not exceed this limit or it will result in permanent distortion of the housing.

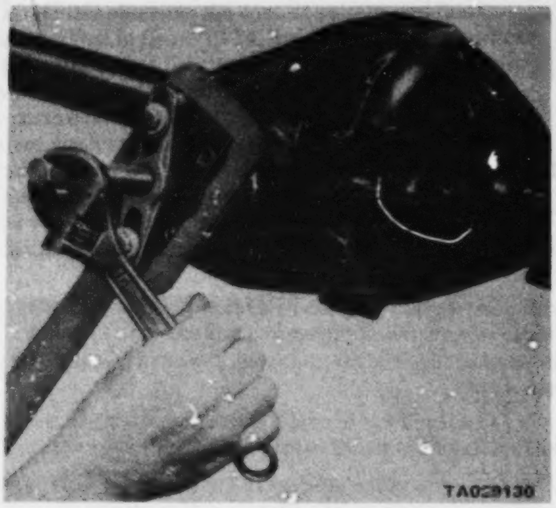


Figure 20-3. Removing Companion Flange (Typical).

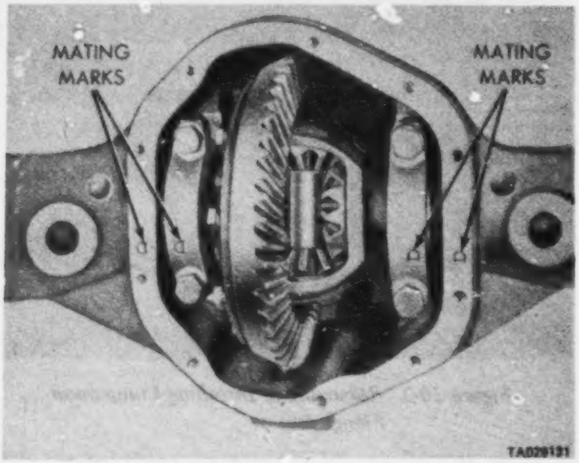


Figure 20-4. Marks on Bearing Caps and Carrier.

(13) Remove the dial indicator fixture.

(14) Pry the differential case assembly loose with a large screwdriver or bar and lift it from the carrier. Pry out the differential case assembly as straight up as possible, using leverage against the differential case and carrier to prevent damage. Place the differential case assembly in a holding fixture or in a vise with soft jaws.

(15) Remove the gear carrier spreader.

(16) Knock out the inner oil seals from the axle tubes with an old axle shaft or rod.

(17) Remove the cups from the differential case bearings. If the bearing cones and cups are not worn or damaged and are to be reassembled, make certain each mating cup and cone are paired together with the bearing cap.

(18) Remove the drive gear mounting bolts and remove the gear. Discard the bolts.

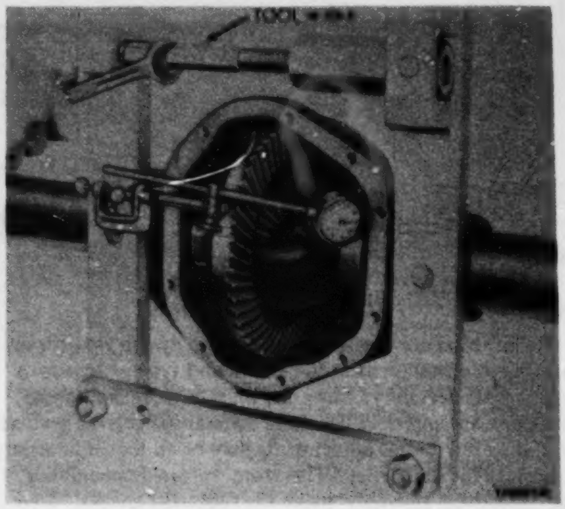


Figure 20-5. Differential Carrier Spreader and Indicator.

(19) Drive out the lockpin securing the differential pinion shaft to the case (figure 20-6).

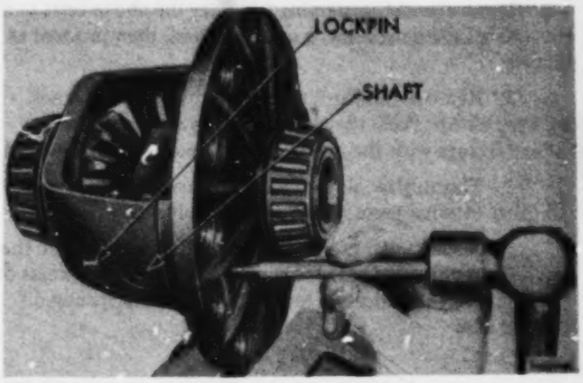


Figure 20-6. Removing Differential Pinion Shaft Lockpin.

(20) Remove the differential pinion mate shaft, the differential pinion mates, and the thrust washers (one in back of each gear). If you found excessive drive gear runout, determine the cause.

(21) If you found no uneven surfaces or other causes preventing good drive gear alinement, check the runout of the drive gear mounting flange surface.

(22) Install the differential assembly (with drive gear removed) in the carrier housing. Attach a dial indicator and check the runout of the drive gear mounting face of the differential case flange.

(23) If the total indicator reading taken while rotating the differential case indicates excessive runout, replace the differential bearing cones or correct the condition by machining a light cut from the drive gear mounting surfaces on the case flange.

(24) Using a press (tool DD-914-P) with ring DD-914-9, C-293-18 plates, and a C-293-3 extension, remove the differential bearing cones (figure 20-7). Be sure that the bearing remover does not pull on the bearing cage.

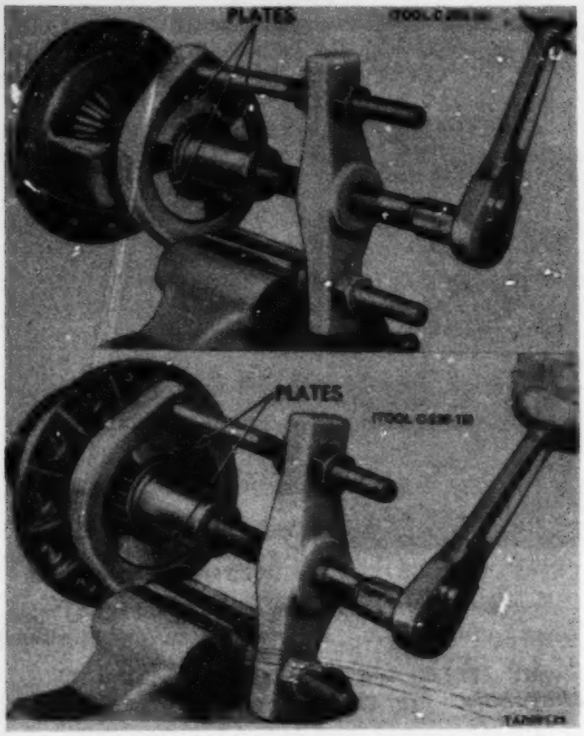


Figure 20-7. Removing Differential Bearings.

(25) Remove the bearing shims. If the drive gear and drive pinion are to be reassembled, note the position of the shims so they may be installed accordingly. Replace damaged shims with new ones of the same thickness.

(26) Place the carrier and tube assembly on an arbor press. Press out the drive pinion shaft and rear bearing cone assembly. Lift the bearing preload shim pack off the shaft assembly and record shim thickness.

(27) Lift out the oil seal gasket, the slinger, and the front bearing cone.

(28) Remove the front and rear bearing cups from the carrier using a drift. Remove the shims from in back of the rear cup and record the thickness of the shims.

(29) Using a press (tool DD-914-P), with ring DD-914-9, and C-293-39 plates, remove the rear pinion bearing cone (figure 20-8). Be sure that the bearing remover is located so as not to pull on the bearing cage.

(30) Wash all parts including the carrier and tube assembly with suitable solvent. Do not steam clean. Figure 20-9 shows an exploded view of the differential assembly.

(31) Examine all bearing surfaces and splines for burrs or scoring. Remove burrs with a hand stone.

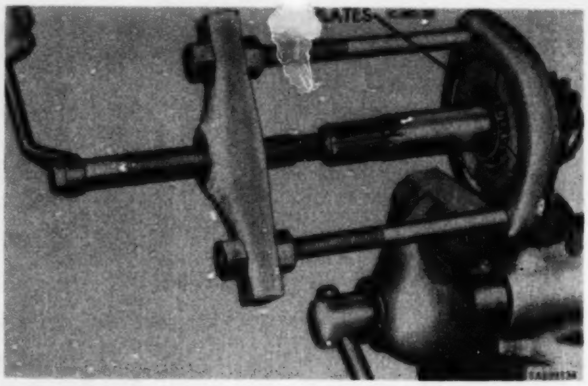


Figure 20-8. Removing Rear Bearing Cone from Pinion.

(32) Check all bearing cups and cones for nicks, roller end wear, grooves, or any damage, and replace accordingly.

(33) Examine the differential pinion mate shaft, pinion mates, side gears, and thrust washers for wear or damage. Replace all defective parts. Pinion mates must be replaced in sets.

(34) All seals, once removed, should be replaced with new parts.

(35) Drive gears and drive pinions are available in matched sets. Do not replace one gear or one pinion only.

b. Assembly and Installation.

(1) Lubricate all parts with differential lubricant. Install the differential side gears and thrust washers, pinion mates and thrust washers, and the pinion mate shaft in the differential case. Aline the hole in the shaft with the hole in the case. Drive in the lockpin. If gears and washers are used, it will not be necessary to check gear backlash since manufacturing tolerances are close and provide correct fit.

(2) Place the differential case assembly in a holding fixture. Install the drive gear with new bolts. Tighten the bolts to 45-60 ft-lbs.

(3) Using tool C-4028-A (figure 20-10), install the differential bearings without shims.

(4) Install spreader tool W-129-A and a dial indicator on the carrier and spread the case 0.015 to 0.020 inch (figure 20-5). Then remove the dial indicator fixture.

(5) Position the bearing cups on the differential bearing cones and place the differential case assembly in the carrier. Install the bearing caps in their correct positions and tighten the bearing cap bolts finger-tight.

(6) Remove the spreader and install the dial indicator fixture with the indicator pointer contacting the back of the drive gear.

(7) Place a screwdriver blade between the bearing cup and housing, and pry the case assembly as far as possible to one side of the housing. Set the dial indicator at zero. Pry the case to the opposite side of the housing and record the reading (figure 20-11). This reading indicates the amount of shims needed behind the side bearings to take up the clearance between the differential bearing cups and the case.

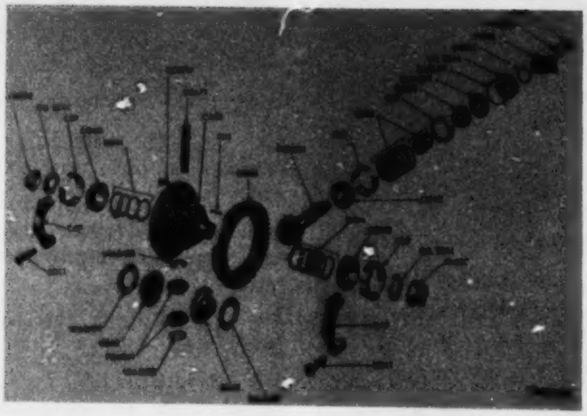


Figure 20-9. Front Differential.

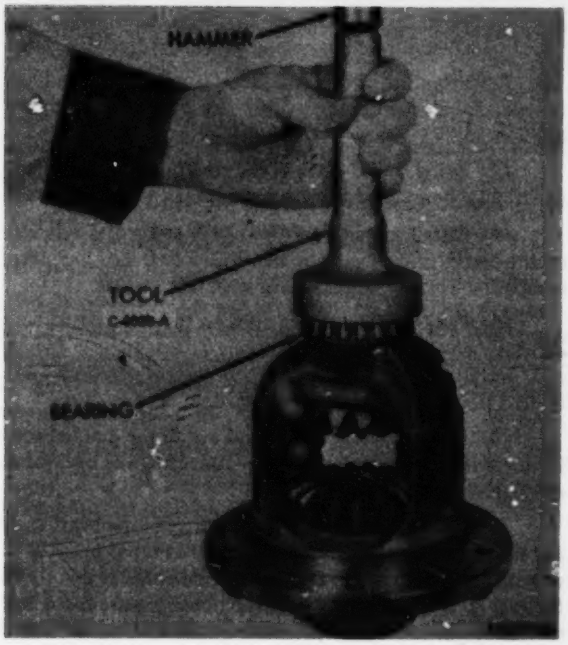

HAMMER
TOOL
BEARING

Figure 20-10. Installing Front Differential Bearing Cone.

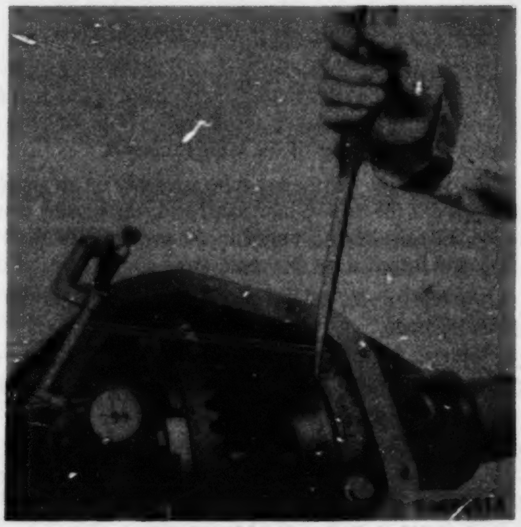


Figure 20-11. Determining Shims to Obtain "O" End Clearance.

(8) Install spreader tool W-129-A and a dial indicator and spread the carrier 0.015 to 0.020 inch. Remove the bearing caps and lift the differential assembly from the housing. Then remove the spreader.

20-2. Drive Pinion Depth of Mesh Setting and Pinion Bearing Preload.

Use tool set C-758-44-60 (figure 20-12) to install the drive pinion bearing cups, and to determine the pinion depth of mesh as follows:

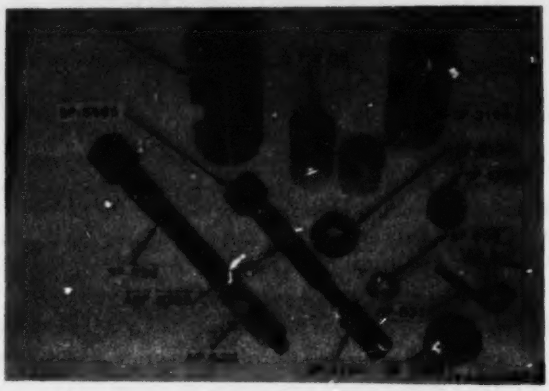


Figure 20-12. Tool Set C-758-44-60.

a. Installing Bearing Cups.

(1) Position the drive pinion cups into the axle housing.

(2) Install adapter SP-5586 on shaft SP-5585. Then install the front bearing cone (figure 20-13).

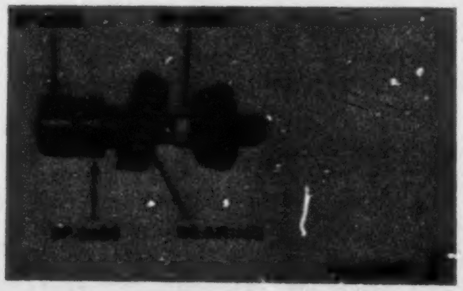


Figure 20-13. Installing the Front Bearing Cone.

(3) Position the tool in the axle housing.

(4) Install adapter SP-5585, the front bearing cone, and adapters SP-3194-B, SP-534, and SP-3193 on tool SP-5385 (figure 20-14).

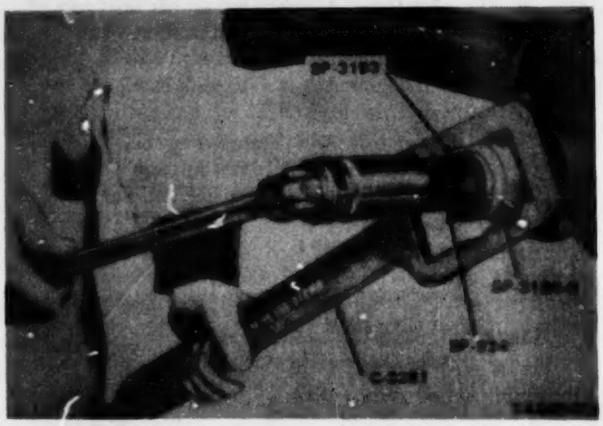


Figure 20-14. Seating Bearing Cups in Axle Housing.

(5) Lubricate the drive pinion bearing cones.

(6) Hold the compression sleeve with tool C-3281, and tighten the compression nut until the cups are seated. Refer to figure 20-14, above.

NOTE

Turn the tool several times while tightening, so the bearing rollers will aline in the cups and prevent damage.

(7) After the bearings are seated, loosen the compression nut. Retighten the nut to produce 10-30 in-lbs of preload (figure 20-15).

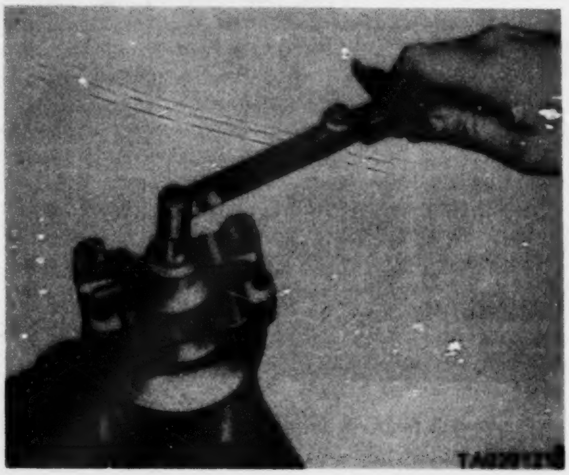


Figure 20-15. Checking Pinion Bearing Preload.

b. Determining Depth of Mesh and Preload.

(1) With pinion tool SP-5385 in place, attach adapter SP-3250 with a cap screw and tighten securely.

(2) Center adapter SP-561 in the axle housing.

(3) Install the differential bearing caps. Torque the bolts to 10 ft-lbs.

(4) Use a feeler gage to select the proper thickness of shims that will fit snugly between adapters SP-561 and SP-3250 (figure 20-16).

NOTE

This measurement will determine the correct thickness shim pack for installation behind the rear pinion bearing cup and the carrier casting.

Figure 20-16. Determining Shim Pack Thickness for Drive Pinion Depth of Mesh.

(5) To select a shim pack, read the markings on the end of the pinion head as shown in figure 20-17. One number is found on both the drive pinion and the ring, which indicates a matched gear set. Directly opposite this number will be one with a "+" or "-" before it, or the number will be "0." This number must be positively identified before continuing the assembly procedure. Midway between the two sets of numbers described above are numbers and letters which are etched for manufacturing purposes only. But as one of these numbers may be "0," it might be confused with the number needed for the assembly procedure. A rule to follow would be to first examine the shaft end for a positive or negative number. If a positive or negative number is not etched on the pinion head, then the number will be zero (see table 19-1).

Figure 20-17. Drive Pinion Markings.

(6) If the marking is negative, add the correct amount of shims. If the marking is positive, subtract the correct amount of shims. Shims are available in 0.003, 0.005, and 0.010 inch thicknesses.

(7) Remove the tool and adapters from the axle housing.

(8) Remove the rear pinion bearing cup and install the correct shim pack.

(9) Reinstall the rear bearing cup as described in a, above.

(10) Lubricate the cone, and install it on the pinion shaft using tool W-262 (figure 20-17.1).

CAUTION

To prevent damage to the bearing, do not strike the bearing cage during installation.

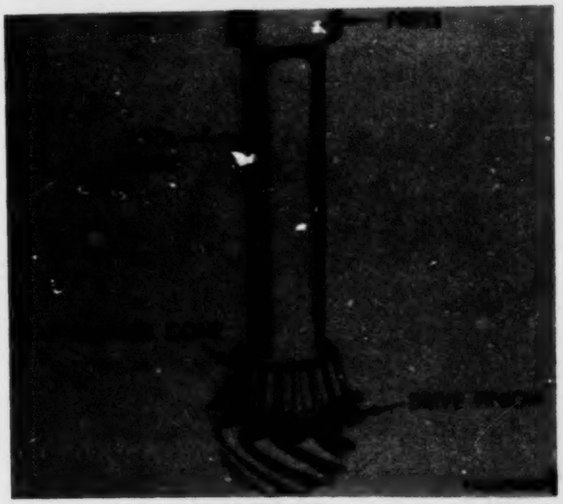


Figure 20-17.1. Installing the Front Pinion Bearing Cone.

(11) Install the drive pinion and bearing assembly in the carrier.

(12) Install the original front bearing shim pack followed by the front bearing cone.

(13) Install the companion flange and nut. Tighten the nut to 220-220 ft-lbs.

(14) To check torque, rotate the pinion shaft with an inch-pound torque wrench. The drive pinion must be vertical for this check. The torque reading to start the shaft turning will be disregarded. The torque reading while rotating the shaft should be 20-40 in-lbs with new bearings or 10-20 in-lbs if the old bearings were used.

(15) Add or remove shims from behind the front bearing cone to obtain the correct (bearing preload) turning torque. Shims are available in the following thicknesses: 0.003, 0.005, 0.010, and 0.030 inch.

(16) After the correct bearing preload has been established, pinion setting depth should be rechecked.

(17) Remove the companion flange and nut.

(18) Install the oil slinger and gasket. Install a new oil seal. If the dust shield has been removed, install a new dust shield.

(19) Install the companion flange, washer, and nut. Tighten the nut to 200-220 ft-lbs, holding the flange with tool C-3281.

(20) Turn the carrier and tube assembly in the holding fixture with the cover side facing upward. Install the axle shaft inner oil seals.

20-3. Differential Bearing Preload and Drive Gear and Pinion Backlash.

a. With the drive pinion and bearings installed and the bearing preload set, install the differential case and ring gear assembly with their respective bearing cups. Install the bearing caps in their positions, aline identification marks, and tighten the cap bolts finger-tight. Refer to the measurement taken in step 7, paragraph 20-1*b*. This reading, taken before the drive pinion was installed, represents the total clearance between the differential bearing cups and the carrier casting. Perform the following steps to determine the thickness of shims required behind each bearing cone to take up the clearance and establish the correct bearing preload and backlash.

b. Install a dial indicator and position the contact point against the back face of the ring gear. Move the differential and ring gear assembly tight against the drive pinion. Set the dial indicator on "0." Move the differential and ring gear assembly in the opposite direction as far away from the pinion as possible, and note the reading on the dial indicator. This reading represents the thickness of shim pack necessary to take up the clearance between the bearing cup and the case on the ring gear side of the differential assembly. Subtract this reading from the previously recorded total reading to obtain the amount of shims necessary to take up the clearance between the bearing cup and the case at the pinion side of the differential.

c. Remove the differential and ring gear assembly from the carrier.

d. Remove the differential bearing cones. Install the correct thickness shim pack as determined in step 2, between the bearing cone and the differential case hub shoulder, using tool C-4028-A. Add an additional 0.015-inch shim to the drive gear tooth side of the differential and install the differential bearing cones. This additional 0.015-inch shim pack provides the correct bearing preload and backlash.

e. Position spreader tool W-129-A in the locating holes of the carrier and tighten the screw finger-tight. Install the dial indicator and spread the carrier 0.015 to 0.020 inch. Do not exceed this limit so that the differential and ring gear assembly can be placed in the carrier.

f. Install the bearing caps in their respective positions as indicated by identification marks on the caps and the carrier. Remove the spreader tool. Coat the bearing cap bolt threads with sealing compound and install and tighten the bolts snugly.

g. Tap the drive gear lightly with a rawhide hammer to properly seat the differential bearing and cups. Care must be taken in this operation to prevent nicking the teeth of the ring gear or drive pinion as they are meshed together. Tighten the bearing cap bolts to 70-90 ft-lbs.

h. Attach a dial indicator to the carrier and with the indicator contact point contacting the ring gear tooth (figure 20-18), measure the backlash between the ring gear and the drive pinion.

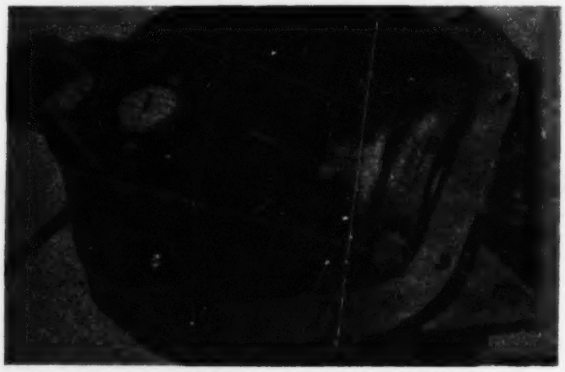


Figure 20-18. Checking Backlash Between Drive Gear and Pinion.

i. Check the backlash at four equally spaced points around the circumference of the ring gear. Backlash must be held between 0.005 and 0.009 inch and cannot vary more than 0.003 inch between the four positions checked. If backlash does not fall within these specifications, change the shim pack thickness on both differential bearing hubs to maintain the proper bearing preload and backlash.

20-4. Gear Tooth Contact Pattern.

Determine the gear tooth contact pattern and adjust it, as necessary, in accordance with paragraph 19-5. The only difference when working on the front differential assembly is that the drive and coast sides are reversed (see figures 19-21 through 19-25).

CHAPTER 21

REPAIR OF THE STEERING BOX AND STEERING COLUMN ASSEMBLY

Section I. REPAIR OF THE STEERING BOX

21-1. Disassembling the Steering Box.

a. General. Thoroughly clean the entire outside surface of the steering gear before disassembly to avoid contaminating the wormshaft and ball nut assembly with dirt or grit.

b. Disassembly Procedure.

(1) Clamp the steering gear in a vise with the jaws on the mounting lug.

(2) Rotate the wormshaft from stop to stop, counting the turns. Then turn it back exactly halfway, placing it on center.

(3) Loosen the sector shaft adjuster screw locknut and remove the cover-to-housing bolts.

(4) Lift the side cover and sector shaft assembly from the gear housing. Using a plastic hammer, tap lightly on the end of the sector shaft to remove it (figure 21-1).

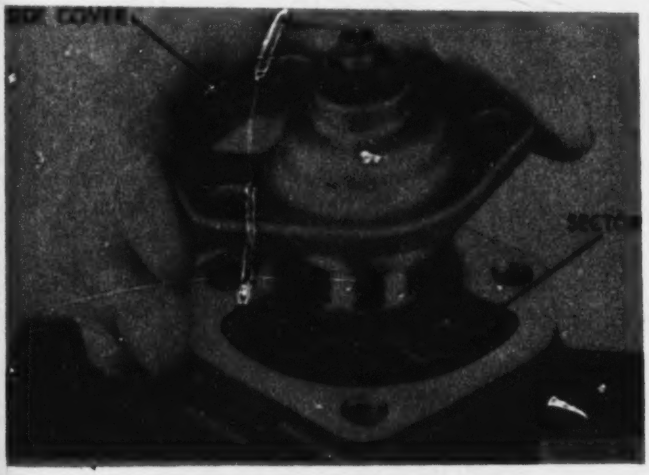


Figure 21-1. Removing Sector Shaft Assembly.

(5) Loosen the wormshaft bearing adjuster locknut and remove the wormshaft bearing adjuster assembly including one bearing and one cup.

(6) Remove the wormshaft and ball nut assembly from the housing (figure 21-2).

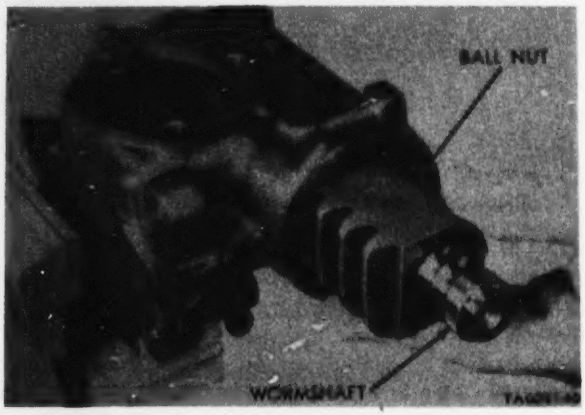


Figure 21-2. Removing Ball Nut and Wormshaft.

CAUTION

Be careful that the ball nut does not run down to either end of the wormshaft. The ball guide ends can be damaged if the ball nut is allowed to rotate until it stops at the end of the worm.

(7) Remove the remaining wormshaft bearing from the gear housing.

(8) Using a screwdriver, pry the lower bearing retainer from the adjuster plug, and remove the bearing (figure 21-3).

(9) Remove the locknut from the sector shaft adjusting screw and remove the screw by turning it clockwise. Slide the adjuster screw and shim out of the slot in the end of the sector shaft.

(10) Remove the wormshaft and sector shaft seals.

(11) Having disassembled the steering gear completely, make sure all parts are clean. Wash the parts in cleaning solvent and dry them thoroughly with compressed air. Check the bearings and bearing cups for signs of defects such as cracks, surface imperfections, and distorted cage. Replace defective parts.

21-2. Recondition Gear.

a. Sector Shaft Bushing - Side Cover. Check the sector shaft and bushing for wear. If the clearance resulting from bushing wear is excessive, replace the entire side cover and bushing assembly.

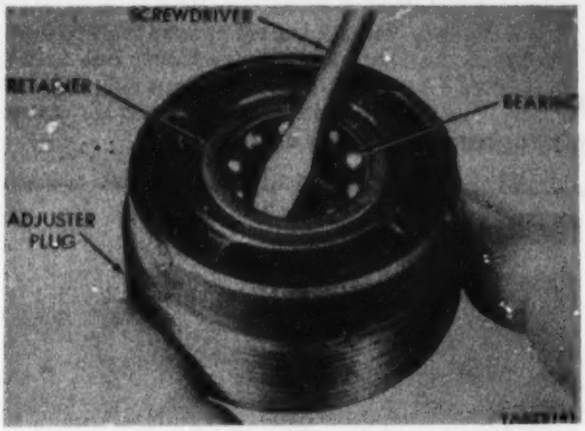


Figure 21-3. Removing Lower Bearing Retainer.

b. *Sector Shaft Bushing Replacement - Housing.*

(1) Support the steering gear housing in an arbor press. Press the sector shaft bushing and seal from the housing.

(2) Press the new bushing into position. No reaming is necessary after installation as service bushings are machined to size. Install the seal using a suitable tool. Install a new seal whenever a seal has been removed, or if signs of wear are evident.

c. *Wormshaft Bearing - Adjuster Cup Replacement.*

(1) Hold the wormshaft adjuster in a vise. Using a slide hammer, remove the bearing cup.

(2) Press the new bearing cup into position using adapter C-4176.

d. *Wormshaft Bearing Cup Replacement - Housing.*

(1) Drive the bearing cup out of the housing with the aid of a drift or punch.

(2) Press the new bearing cup into position using adapter C-4176.

21-3. Ball Nut.

a. *Side-Loading Guides.* If there is no indication of binding or tightness in the ball bearing nut assembly when the wormshaft is rotated, disassembling the unit is unnecessary. If, however, tightness or binding is noticed, disassemble, clean, and inspect the unit to determine the cause. Use the following procedure:

(1) Remove the screws and ball retaining clamp. Remove the guides from the nut.

(2) Invert the nut, rotate the wormshaft in both directions to permit the balls to drop out. (Make sure your work area is clean.) Having removed all of the balls, remove the nut from the wormshaft.

(3) Wash the parts, using a cleaning solvent, and dry them with compressed air. Using a magnifying glass, inspect the parts for defects. Check the ball guide ends for damage. Replace defective parts.

(4) Hold the ball nut with the helical grooved bore in a horizontal position with the ball guide holes facing upward. Position the shallow side of the rack teeth toward the left as viewed from the steering wheel end. Insert the wormshaft, alining the wormshaft grooves with the grooves in the nut.

(5) Count 27 balls (the number of balls for one circuit) into a clean container. Place 20 of these balls into one of the guide holes. It may be necessary to push them in with the aid of a pin punch (figure 21-4).

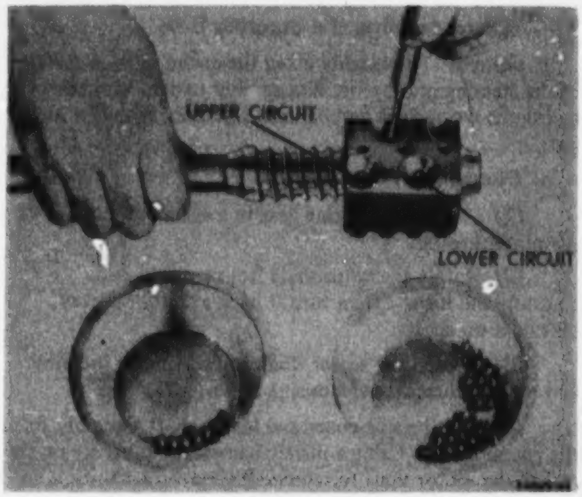


Figure 21-4. Filling Ball Circuit (Closed Type).

CAUTION

Do not rotate the wormshaft until both circuits, complete with balls, are installed.

(6) Place one set of ball guides on the bench, with the ball groove in each guide half facing upward. Position the remaining seven balls into the groove of one ball guide half and cover them with the second guide half. Holding the two halves together, plug the opening on each end with a dab of grease to keep the balls in place while installing the guide assembly (figure 21-5).

(7) Push the guide assembly into the guide holes of the nut. If a slight bind is encountered, tap it lightly into place with a screwdriver handle. After the guide assembly is in position, one ball circuit is completed.

(8) Use the same procedure to assemble the second ball circuit. Install the ball guide clamp and tighten the screws to 30 ft-lbs. Rotate the nut on the worm to check for binding and free movement.

CAUTION

Do not rotate the nut to the end of the worm threads or damage will result to the ball guides.

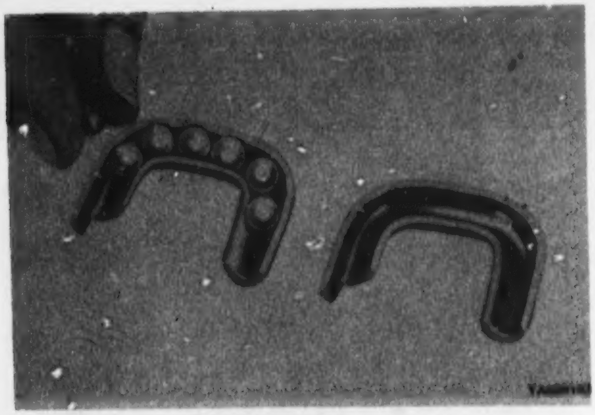


Figure 21-5. *Filling Ball Guides.*

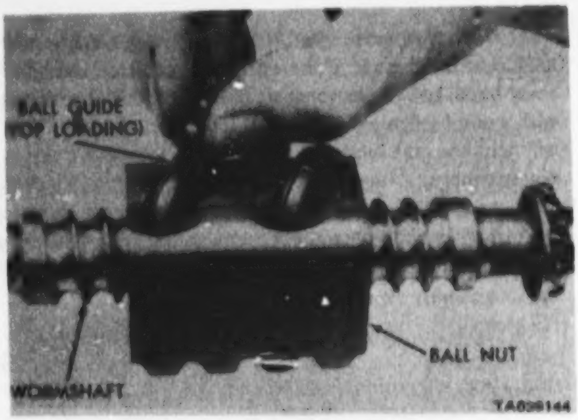


Figure 21-6. Filling Ball Guide and Circuit (Top-Loading Type).

b. Top-Loading Style Ball Guide. Refer to figure 21-6.

(1) Slip the ball nut over the wormshaft with the ball guide holes facing upward, and the shallow end of the ball nut teeth toward the left as viewed from the steering wheel position. Aline the grooves in the worm and nut by sighting through the ball guide holes.

(2) Place two ball guide halves together and insert them into the upper circuit in the ball nut. Place the remaining two guides together and insert them in the lower circuit.

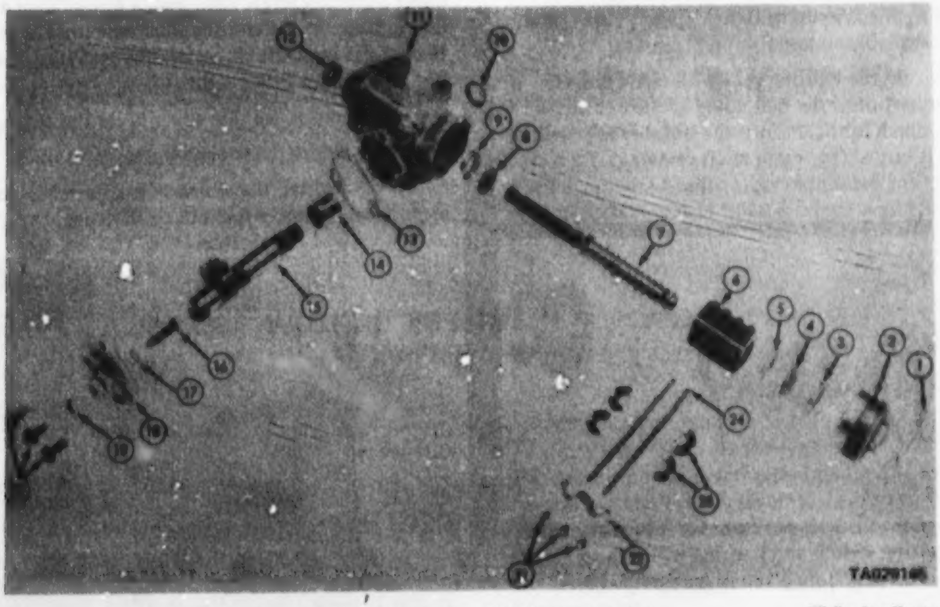
(3) Count 25 balls into a clean container. This is the correct number of balls for one circuit.

(4) Load the balls into one of the guide holes while turning the wormshaft gradually away from that hole. When all 25 of the balls have been installed, the circuit is complete.

(5) Fill the remaining ball circuits in the same manner.

21-4. Reassembling the Steering Box.

Refer to figure 21-7.



LEGEND for Figure 21-7:

1-Worm bearing adjuster locknut
2-Worm bearing adjuster
3-Lower worm bearing cup
4-Lower ball bearing
5-Lower bearing retainer
6-Ball nut
7-Wormshaft
8-Upper ball bearing
9-Upper worm bearing cup
10-Sector shaft seal
11-Housing
12-Wormshaft seal
13-Side cover gasket
14-Sector shaft bushing
15-Sector shaft
16-Lash adjuster
17-Lash adjuster shim
18-Housing side cover and bushing assembly
19-Lash adjuster locknut
20-Side cover bolts
21-Ball guide clamp screws
22-Ball guide clamp
23-Ball guides
24-Recirculating balls

Figure 21-7. Steering Gear.

a. General Information. After completing a major overhaul, coat the threads of the wormshaft adjuster, the side cover bolts, and the sector shaft lash adjuster bolt sparingly with a non-hardening oil resistant sealing compound. This will help keep the lubricant from leaking from the steering gear assembly. After installing new sector shaft and wormshaft seals, and assuring that the sector shaft bushings and wormshaft bearing cups in the gear housing are satisfactory, continue with the assembly procedure.

b. Assembly Procedure.

(1) Hold the gear housing in a vise by clamping a mounting lug in the vise, with the wormshaft bore in a horizontal position and the side cover opening facing upward.

(2) With the upper ball bearing on the wormshaft, install the wormshaft and nut assembly into the housing, positioning the wormshaft through the upper ball bearing cup and seal.

(3) Assemble the ball bearing and seal into the wormshaft adjuster plug. Press the retainer into position.

(4) Place the adjuster and locknut into position, guiding the wormshaft into the bearing. Tighten the adjuster until very little wormshaft end play remains.

(5) Place the sector shaft lash adjuster screw, with shim, in the slotted end of the sector shaft. With the adjuster screw positioned in the slot at the end of the sector shaft, check the end clearance of the screw (figure 21-8). Hold the clearance to 0.002 inch or less. A selection of four shims having thicknesses of 0.063, 0.065, 0.067, and 0.069 inch are available.

(6) Lubricate the steering gear with GAA grease. Turn the wormshaft until the ball nut is at the end of its travel. Pack as much lubricant into the housing as possible, without losing it out of the sector shaft opening. Turn the wormshaft until the ball nut is at its other extreme. Pack as much lubricant into the housing as possible.

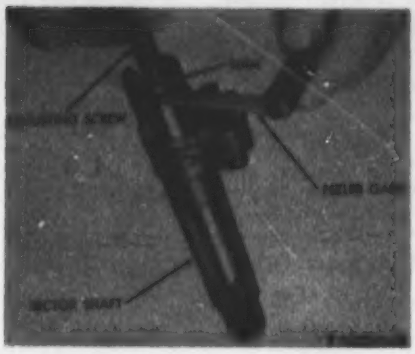


Figure 21-8. Checking Lash Adjuster End Clearance.

(7) Rotate the wormshaft to bring the ball nut to the center of its travel.

(8) Install the sector shaft assembly, including the adjuster screw and shim, into the housing. Engage the center tooth of the sector with the tooth space in the center of the ball nut.

(9) Pack more lubricant into the housing and make sure that the side cover bushing bore is lubricated.

(10) Position the side cover gasket.

(11) Install the side cover. Reach through the side cover adjusting screw hole with a screwdriver and turn the lash adjuster screw counterclockwise until it bottoms. Then turn in the opposite direction one half turn. Start the locknut and tighten finger-tight.

(12) Install the side cover bolts and tighten to 30 ft-lbs.

(13) Adjust the steering gear.

(14) Tighten the wormshaft adjuster locknut and sector shaft adjuster locknut to 85 ft-lbs.

Section II. REPAIR OF THE STEERING COLUMN ASSEMBLY

21-5. Steering Column Assembly.

a. General. The following procedures are for use in repairing the steering column after it has been removed from the truck. Steering column removal and installation is covered in paragraph 7-20. Procedures for removing and installing the ignition switch and housing while the steering column is still in the truck are given in paragraph 10-3.

b. Disassembling the Column.

(1) Clamp the column assembly in a vise.

(2) Drive out the gear selector lever pin, then remove the lever and spring from the housing.

(3) Remove the turn signal switch and upper bearing retainer screws. Remove the retainer and lift the switch up out of the way (figure 21-9). Remove the turn signal lever.

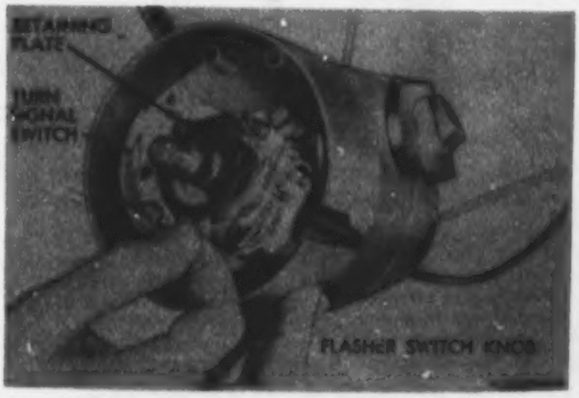


Figure 21-9. Retainer and Turn Signal Switch

(4) Remove the two retaining screws and lift the lamp assembly out of the way.

(5) Remove the snap ring from the upper end of the steering shaft (figure 21-10).

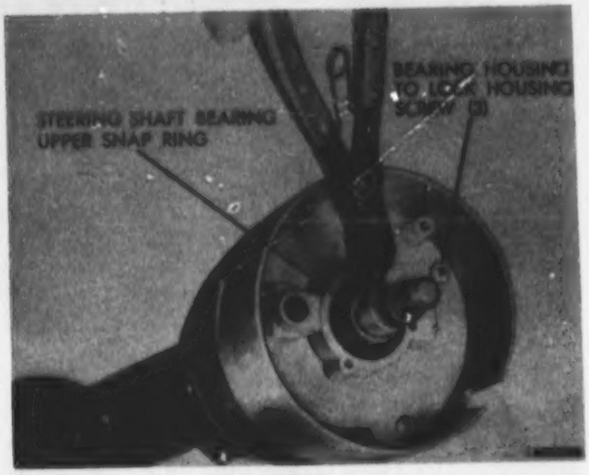

STEERING SHAFT BEARING UPPER SNAP RING
BEARING HOUSING TO LOCK HOUSING SCREW (3)

Figure 21-10. Removing Steering Shaft Bearing Upper Snap Ring.

b. Steering Shaft and Bearing Housing. Remove the three screws which hold the bearing housing to the lock housing.

CAUTION

These screws must be removed before steering shaft removal.

(1) Install steering shaft remover C-4044, and press the shaft out of the bearing. Remove the bearing housing from the shaft (figure 21-11).

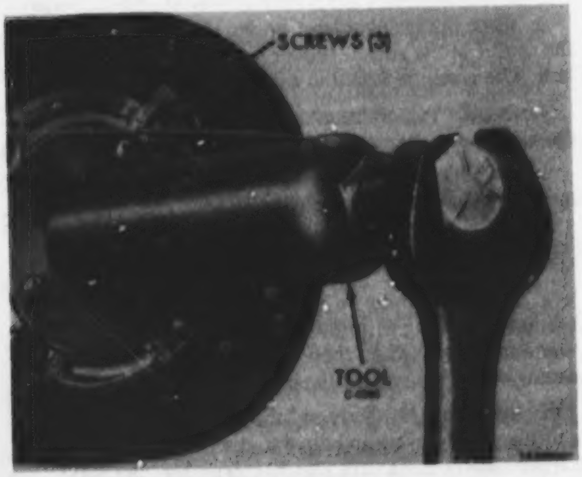

SCREWS (3)
TOOL

Figure 21-11. Pressing Shaft Out of Bearing.

(2) Remove the bearing lower snap ring from the shaft.

(3) Remove the shaft through the lower end of the column.

c. Lock Housing.

(1) Place the cylinder in the LOCK position and remove the key. Insert a small diameter screwdriver or a similar tool into the lock cylinder release hole and push in to release the spring-loaded lock retainer. At the same time, pull the lock cylinder out of the housing bore (figure 21-12) and remove the ignition switch assembly.

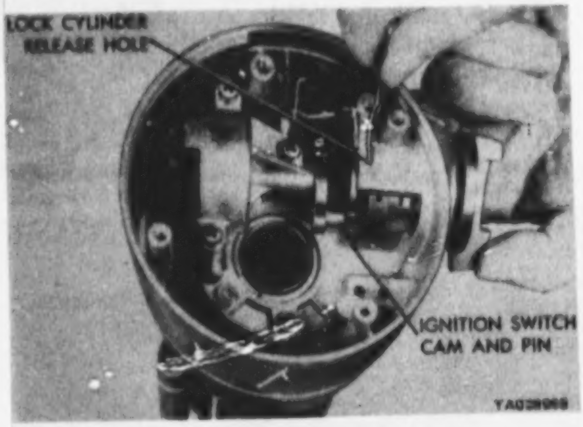

LOCK CYLINDER RELEASE HOLE
IGNITION SWITCH CAM AND PIN

Figure 21-12. Removing Lock Cylinder.

(2) Remove the shift indicator and lamp assembly.

(3) Remove the four lock-housing-to-column jacket hex head retaining screws and remove the lock housing from the jacket (figure 21-13).

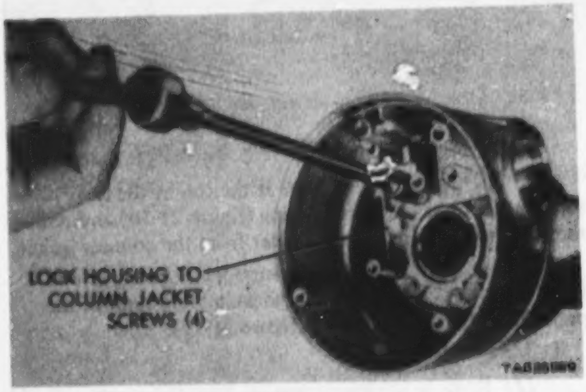

LOCK HOUSING TO COLUMN JACKET SCREWS (4)

Figure 21-13. Lock-Housing-to-Column Jacket Retaining Screws.

d. Shift Tube and Housing.

(1) To remove the shift tube, first straighten the tabs at the top of the shift tube which are bent outward against the shift housing casting.

(2) Removal procedure is as follows:

(a) Remove the shift lever and shift lever gate spring from the shift housing (figure 21-14).

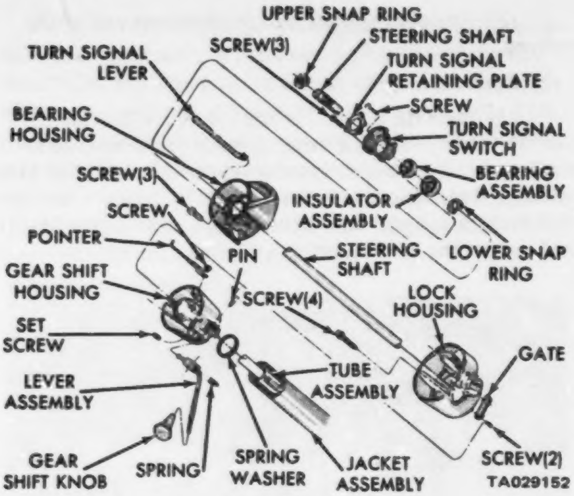

UPPER SNAP RING
STEERING SHAFT
TURN SIGNAL RETAINING PLATE
SCREW(3)
TURN SIGNAL LEVER
SCREW
TURN SIGNAL SWITCH
BEARING HOUSING
BEARING ASSEMBLY
SCREW(3)
INSULATOR ASSEMBLY
SCREW
POINTER
STEERING SHAFT
LOWER SNAP RING
PIN
GEAR SHIFT HOUSING
SCREW(4)
LOCK HOUSING
SET SCREW
GATE
TUBE ASSEMBLY
LEVER ASSEMBLY
GEAR SHIFT KNOB
SPRING
SPRING WASHER
JACKET ASSEMBLY
SCREW(2)
TA029152

Figure 21-14. Steering Column.

(b) Loosen the shift tube set screw in the shift housing (figure 21-15).

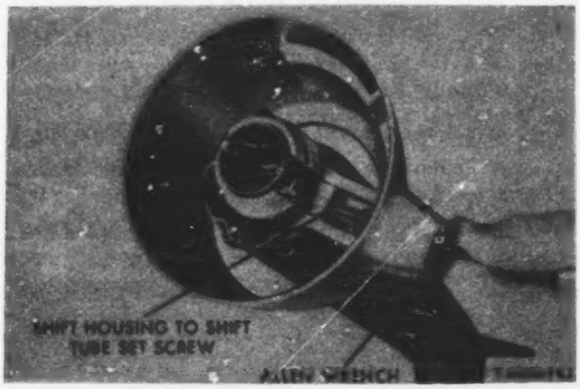

SHIFT HOUSING TO SHIFT TUBE SET SCREW
ALLEN WRENCH

Figure 21-15. Shift Tube Set Screw.

(c) Straighten the tabs at the top of the shift tube so they will clear the shift housing (figure 21-16) and remove the shift housing and spring washer from the column jacket.

(d) Remove shift tube support retaining screws from the lower end of the column jacket and remove the parts from the column jacket (figure 21-17).

e. *Column Jacket.*

(1) Remove the spring washer from the upper end of the jacket.

(2) Remove the "O" ring and support plate assembly parts from the lower end of the jacket.

21-6. Reassembling the Column.

a. Install the "O" ring retainer, "O" ring, and floor plate on the lower end of the column jacket. This must be done before installing the shift tube.

b. Slide the shift tube and support into the column jacket. Aline the holes and install screws through the jacket into the support at the lower end of the jacket. Tighten to 30 in-lbs.

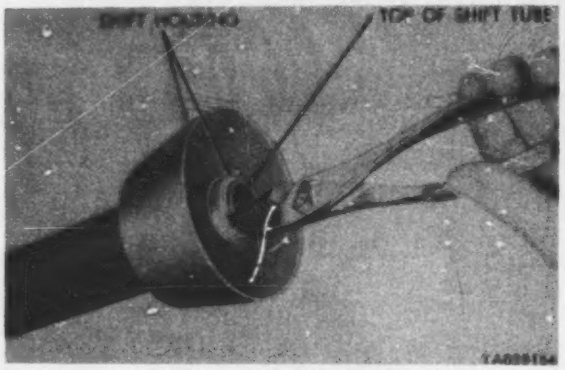

SHIFT HOUSING
TOP OF SHIFT TUBE
TA029154

Figure 21-16. Bending Shift Tube Tabs.

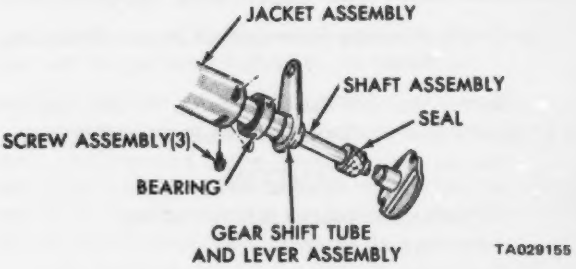

JACKET ASSEMBLY
SHAFT ASSEMBLY
SEAL
SCREW ASSEMBLY(3)
BEARING
GEAR SHIFT TUBE AND LEVER ASSEMBLY
TA029155

Figure 21-17. Lower Steering Column.

c. Place the spring washer on the shift housing so that the center of the curved washer bears against the housing hub. Use grease to hold the washer in place (figure 21-18).

d. Install the shift housing over the jacket while guiding the shift tube key into the slot in the housing (figure 21-19).

e. Hold the parts firmly together and tighten the lock screw in the shift housing (figure 21-15).

f. Bend the corners of the slot in the shift tube out against the shift housing casting (figure 21-16).

g. Seat the housing on top of the jacket, indexing the key in the housing with the slot in the jacket. Insert all four screws and tighten them alternately to insure proper seating of the housing on the jacket. Tighten to 80 in-lbs.

h. Insert the shift lever and the shift lever gate spring into the shift housing and drive in the retaining rolled pin. Support the housing with a socket to protect the paint.

i. Install the lock housing (paragraph 10-3).

j. With the ignition key cylinder in the LOCK position, and with the key removed, insert the key cylinder into the

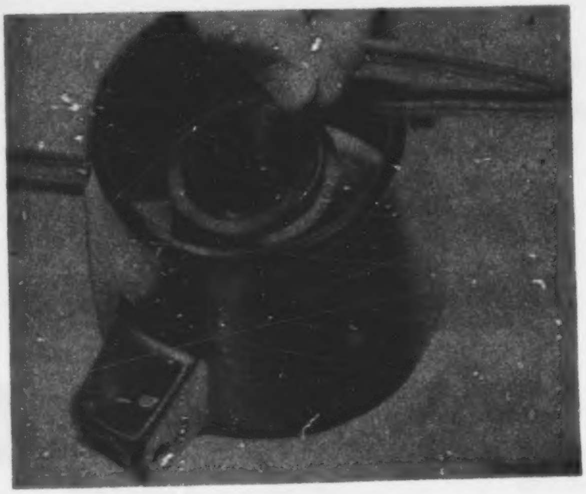


Figure 21-18. Shift Housing and Spring Washer.

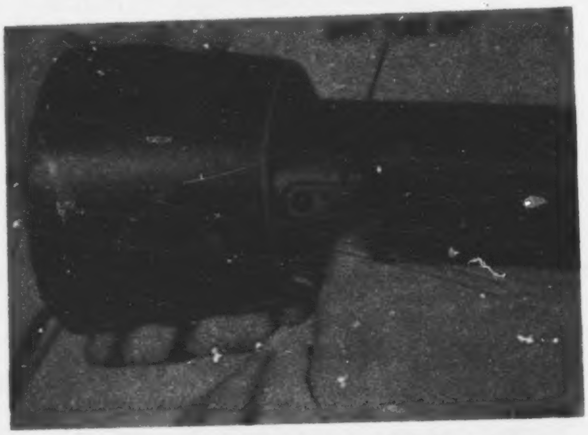


Figure 21-19. Installing Shift Tube in Shift Housing.

lock housing. Press the cylinder into place until contact is made with the pin on the ignition switch cam. Insert the key into the lock and rotate the lock until the slot in the cylinder plate lines up with the pin. Press the key cylinder all the way into the lock housing, making sure the retainer bar snaps into its slot in the lock housing.

21-7. Installing the Steering Shaft.

a. Insert the steering shaft assembly into the column and shift tube assembly.

b. Install the bearing lower snap ring on the steering shaft.

21-8. Assembling the Bearing Housing.

a. Place the rubber insulator with ground staple over the column upper bearing and install the assembly into the bearing housing bore. Use a soap solution or rubber lubricant to ease installation.

b. Install the turn signal switch in the bearing housing, feeding the wires through the opening in the housing.

c. Install the retaining plate over the switch and tighten the three screws to 27 in-lbs.

d. Install the turn signal lever or turn signal speed control lever on the turn signal switch.

e. Position the bearing housing assembly on the column jacket assembly, feeding the wires through the space between the lower housings and the jacket.

f. When installing this housing, the steering shaft must be drawn, not pushed, through the bearing, using the bearing inner cup as a reaction member. Otherwise, damage to the lock housing components or bearing could result. Do not drive the shaft into the bearing.

g. Install tool C-3879 on the steering shaft, with the washer and steering wheel nut (figure 21-20). Turn the nut to pull the shaft through the bearing. Remove the tool and install the upper snap ring on the shaft.

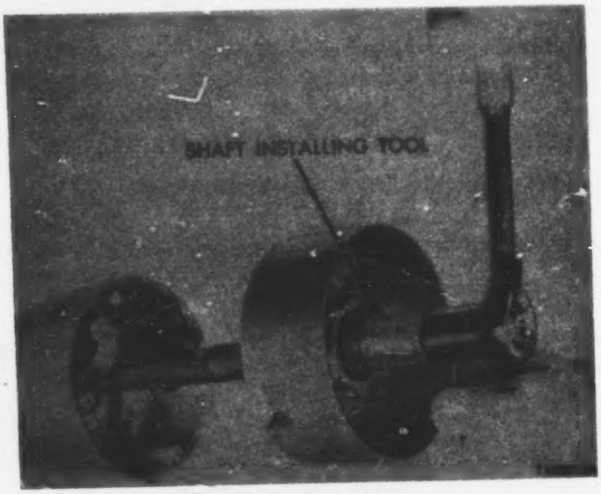


Figure 21-20. Pulling Shaft into Bearing.

h. Install the lamp assembly in the bearing housing.

i. Install the harness cover in place over the wires, being careful not to pinch the wires between the harness cover and jacket.

CHAPTER 22

REPAIR OF THE BRAKE SYSTEM

22-1. Master Cylinder.

a. General. The tandem master cylinder is of the compensating type with reservoir cast integrally (figure 22-1). The master cylinder has a front and rear piston with two outlets. The outlet holding the rear brakes contains a residual pressure valve.

b. Repair. Repair of the master cylinder is not authorized. If the master cylinder is defective, it will be replaced with a serviceable one.

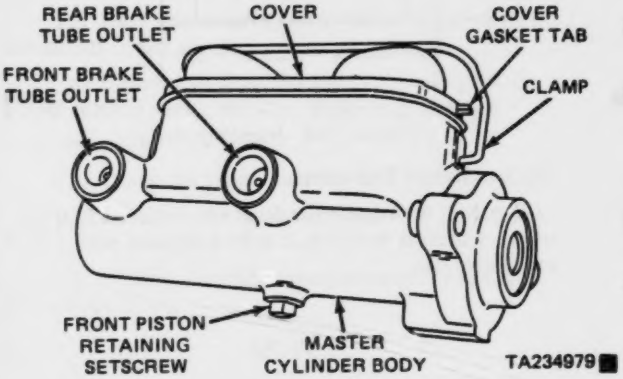


Figure 22-1. Tandem Master Cylinder Assembly.

22-2. Brake Caliper Assembly.

a. Piston Removal.

(1) Clamp the brake caliper in a vise with protected jaws.

(2) Remove the piston using the following procedures:

(a) Position a block of wood (about 3/8 inch thick) where the outboard shoe belongs.

(b) Close the bleeder valve, if it is open.

(c) Using compressed air (regulated to a pressure of less than 25 psi), remove the piston by blowing air into the caliper brake line hole.

WARNING

When removing the piston from the caliper, do not use more than 25 psi air pressure. Do not put your hand or anything else between the block of wood and the piston.

(3) Remove the piston boot and discard it.

(4) Using a pointed wooden or plastic stick, remove the piston seal from the caliper cylinder bore and discard it.

b. Cleaning and Inspection.

(1) Clean all rust from the surface of the caliper housing.

(2) Clean all parts using denatured alcohol. Blow dry with air.

(3) Blow out all the drilled passages.

(4) Inspect the cylinder bore, piston, seal, and boot groove for damage. Replace, if necessary.

NOTE

If corrosion is present in the boot or seal groove, remove it using a fiber brush.

(5) Use a wire brush to remove rust or corrosion from the surface of the adapter.

(6) Inspect and clean the anti-rattle spring and the caliper support spring and key. Replace, if damaged.

c. Assembly.

(1) Clamp the caliper in a vise with protected jaws.

(2) Lubricate the new piston seal with clean brake fluid.

(3) Position the seal in the groove of the cylinder bore (figure 22-2).

NOTE

Be sure the seal is not rolled or twisted.

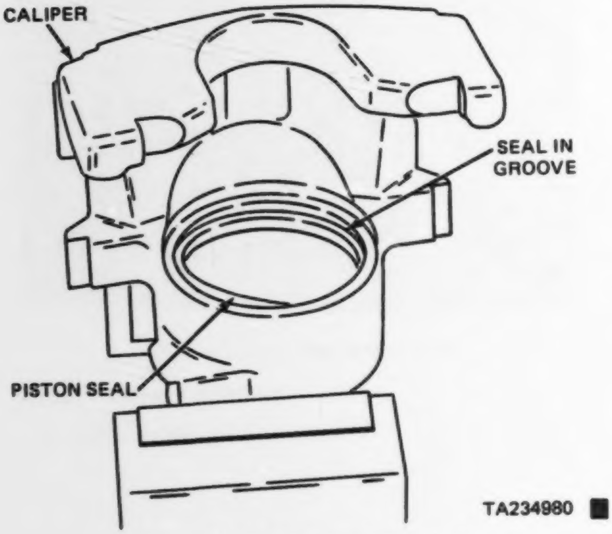


Figure 22-2. Installing Piston Seal.

(4) Coat the new piston boot with brake fluid. Use your finger to install the boot in the caliper by working it into the outer groove (figure 22-3).

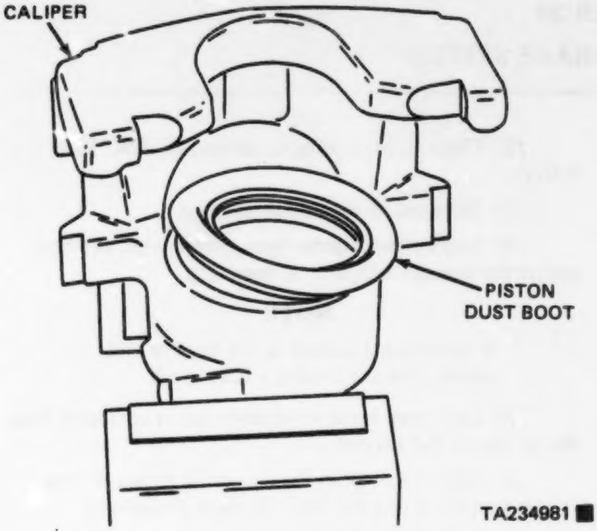

CALIPER
PISTON
DUST BOOT
TA234981

Figure 22-3. Installing Piston Dust Boot.

(5) Coat the piston with brake fluid.

(6) Spread the boot with your fingers and work the piston into the boot (figure 22-4). Push it down until it bottoms.

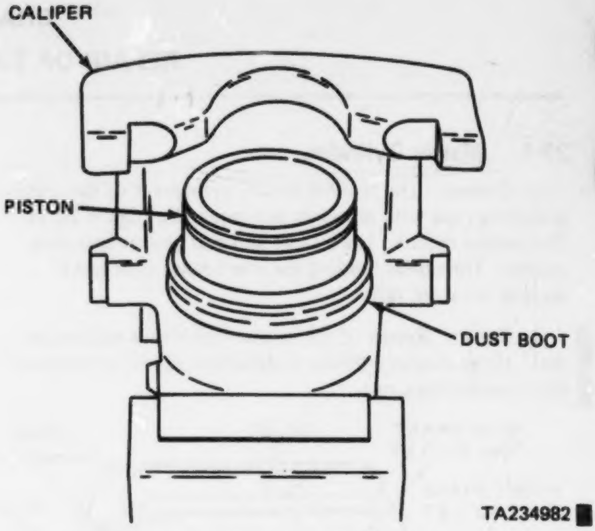

CALIPER
PISTON
DUST BOOT
TA234982

Figure 22-4. Installing Piston.

22-3. Wheel Cylinders.

Repair of the wheel cylinder is not authorized. If the wheel cylinder is defective, it will be replaced with a serviceable one.

(3) Remove the piston boot and discard it.

(4) Using a pointed wooden or plastic stick, remove the piston seal from the caliper cylinder bore and discard it.

b. Cleaning and Inspection.

(1) Clean all rust from the surface of the caliper housing.

(2) Clean all parts using denatured alcohol. Blow dry with air.

(3) Blow out all the drilled passages.

(4) Inspect the cylinder bore, piston, seal, and boot groove for damage. Replace, if necessary.

NOTE

If corrosion is present in the boot or seal groove, remove it using a fiber brush.

(5) Use a wire brush to remove rust or corrosion from the surface of the adapter.

(6) Inspect and clean the anti-rattle spring and the caliper support spring and key. Replace, if damaged.

c. Assembly.

(1) Clamp the caliper in a vise with protected jaws.

(2) Lubricate the new piston seal with clean brake fluid.

(3) Position the seal in the groove of the cylinder bore (figure 22-8).

NOTE

Be sure the seal is not rolled or twisted.

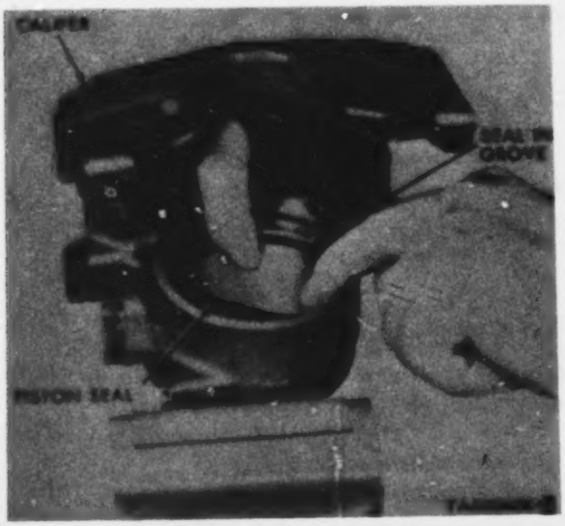


Figure 22-8. Installing Piston Seal.

(4) Coat the new piston boot with brake fluid. Use your finger to install the boot in the caliper by working it into the outer groove (figure 22-9).

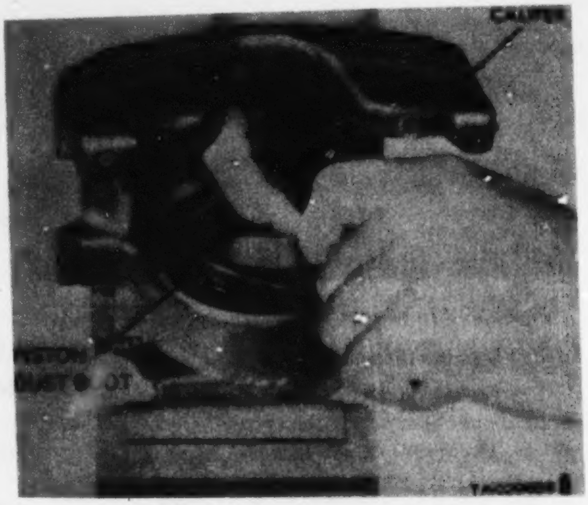


Figure 22-9. Installing Piston Dust Boot.

(5) Coat the piston with brake fluid.

(6) Spread the boot with your fingers and work the piston into the boot (figure 22-10). Push it down until it bottoms.

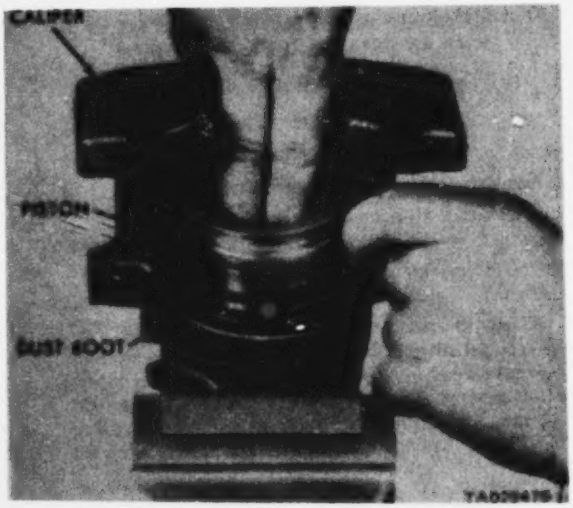


Figure 22-10. Installing Piston.

22-3. Wheel Cylinders.

a. Disassembly (see figure 22-11).

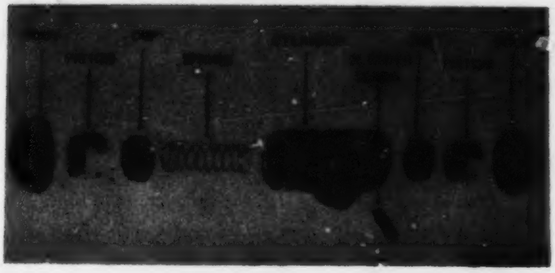


Figure 22-11. Wheel Cylinder (Disassembled View).

(1) Remove the boots.

(2) Press in on the end of the cylinder and force out both pistons, both cups, and the spring.

b. Inspection.

(1) Wash the wheel cylinder and pistons with clean brake fluid.

(2) Remove all dust with a cloth and clean a second time with denatured alcohol.

(3) Dry the wheel cylinder and pistons with air pressure.

NOTE

Make sure the bleeder screw port and screw are clean and open.

(4) Using a hone, clean the cylinder walls.

NOTE

A cylinder that does not clean up at 0.002 inch should be replaced.

c. Assembly.

(1) Dip the pistons and new cups in brake fluid before assembly.

(2) Install the spring in the cylinder.

(3) Install the wheel cylinder cups in each end of the cylinder with the open end of the cups facing each other.

(4) Install the pistons.

(5) Install the boots.

CHAPTER 23

LITTER COMPARTMENT HEATER (AMBULANCE)

23-1. General.

The litter compartment heater is a self contained, gasoline burning unit that works independently of the vehicle's engine.

23-2. Burner Assembly.

a. Removal and Inspection.

(1) Disconnect the spark plug cable.

(2) Disconnect the red wire from the fuel solenoid coil.

(3) Disconnect the ground wire from the spark plug cap.

(4) Remove the combustion air elbow.

(5) Loosen the burner clamp, and separate the burner from the heat exchanger. Remove the burner.

(6) Inspect the burner for the following conditions:

(a) The nozzle and inside of the louver plate and mixer assembly should be coated with a medium layer of black carbon, and the fuel nozzle should have a small gray opening at the orifice.

(b) The outer end of the mixer should be burned to a gray or reddish color. Some scaling or loose particles may be present and should not be considered a defect. Indications of improper operation are an uneven buildup of black, sooty carbon or an excessively burned or eroded spot on the mixer.

(c) All air holes in the mixer must be open to allow the combustion air to mix with the fuel. Also check for evidence of fuel leakage around the fuel inlet connector and between the solenoid coil cup and burner base.

(d) The burner should be replaced as a unit if any parts are burned through or damaged.

b. Installation.

(1) Position the burner assembly on the heat exchanger, and tighten the clamp.

(2) Install the combustion air elbow.

(3) Connect the ground wire to the spark plug cap.

(4) Connect the red wire to the fuel solenoid coil.

(5) Connect the spark plug cable.

23-3. Spark Plug.

a. Replacement. The spark plug should not be replaced unless the ceramic part of the plug is cracked or chipped. To replace it, use the following procedure:

(1) Remove the burner assembly from the heater (paragraph 23-2).

(2) Remove the cap attaching screws and the cap.

(3) Remove the spark plug and washers.

(4) Install a new spark plug using new washers.

(5) Install the cap, and tighten the attaching screws to 21 inch-pounds.

(6) Set the spark plug gap (*b*, below).

(7) Reinstall the burner assembly in the heater.

b. Setting Gap. To see the gap, bend the ground electrode (not the spark plug electrode) until the gap is set at 0.085 inch using tool ST-8933.

23-4. Ignition Coil.

a. Removal.

(1) Disconnect the spark plug cable from the coil.

(2) Disconnect the two wires from the coil. Mark them for aid in reassembly.

(3) Remove the attaching nut and washer, and remove the coil.

b. Installation.

(1) Position the coil on the mounting stud.

(2) Install the flat washer and attaching nut.

(3) Connect the two wires to the coil.

NOTE

The wire from the ignition unit should be attached to the minus (-) terminal.

(4) Connect the spark plug cable.

23-5. Ignition Unit.

a. Breaker Point Adjustment.

(1) Remove the cover from the ignition unit base.

(2) Rotate the cam until it raises the breaker points' contact arm as far as it will go (figure 23-1).

(3) Rotate the adjusting screw until a gap of 0.018 inch is obtained between the points.

(4) Rotate the cam 180° and recheck the gap. It must be between 0.012 inch and 0.021 inch. If it is not, set the gap at 0.018 inch at this position. Rotate the cam 180° and check the gap again. If it is now between 0.018 inch and 0.021 inch the gap is set. If it still is not within the proper range, replace the ignition unit (*b*, below).

(5) Reinstall the cover.

b. Replacement.

(1) Remove the cover from the ignition unit base.

(2) Disconnect the wires from the ignition unit base.

(3) Remove the attaching screw, and remove the ignition unit and gasket.

(4) Position a new gasket on the ignition unit base, and position the base on the fuel pump.

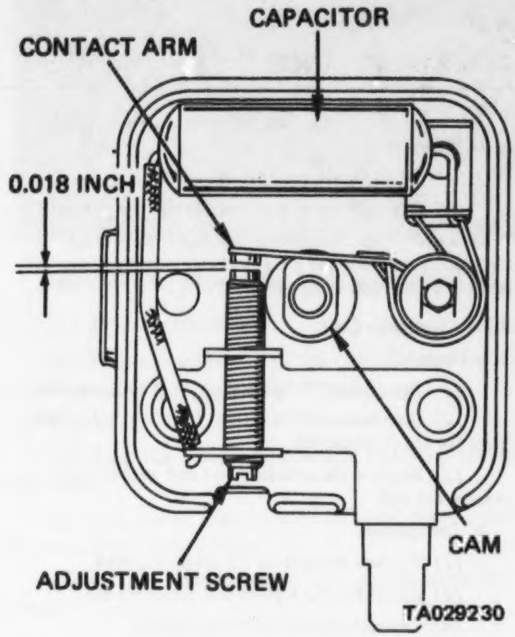


Figure 23-1. Breaker Point Adjustment.

(5) Install the attaching screw.

(6) Adjust the breaker point gap (*a*, above).

(7) Attach the wires.

(8) Install the cover.

23-6. Fuel Pump.

a. Removal.

(1) Disconnect the fuel line hoses from the pump.

(2) Remove the ignition unit (paragraph 23-5).

(3) Remove the attaching nuts and remove the pump.

(4) Remove the coupling, connector, and washer.

NOTE

The connector has left-hand threads.

b. Installation.

(1) Install the washer, connector, and coupling.

(2) Position the pump on the motor, and install the attaching nuts.

(3) Install the ignition unit, and adjust the breaker points (paragraph 23-5).

(4) Connect the fuel lines.

23-7. Combustion Air Blower.

a. Removal.

(1) Remove the ignition unit (paragraph 23-5).

(2) Remove the fuel pump (paragraph 23-6).

(3) Remove the combustion air tube.

(4) Remove the clamp, and remove the blower assembly from the heater.

b. Installation.

(1) Position the blower assembly in the heater, and tighten the clamp.

(2) Install the combustion air tube.

(3) Install the fuel pump (paragraph 23-6).

(4) Install the ignition unit (paragraph 23-5).

23-8. Ventilating Air Blower.

a. Removal.

(1) Disconnect the two electrical leads from the blower assembly.

(2) Loosen the motor support clamp.

(3) Remove the four screws securing the blower housing to the heater mounting base.

(4) Remove the blower assembly.

b. Installation.

(1) Position the blower assembly, and install the four attaching screws.

(2) Tighten the motor support clamp.

(3) Connect the two electrical leads.

23-9. Heat Exchanger.

a. Removal.

(1) Remove the combustion air tube.

(2) Disconnect the control cable from the thermostat control switch.

(3) Disconnect the electrical wires from the switch.

(4) Remove the thermostat control switch attaching screws, and remove the switch.

(5) Remove the overheat switch.

(6) Disconnect the heat exchanger exhaust tube outlet from the extension.

(7) Remove the heat exchanger assembly.

(8) Remove the two screws which secure the wrapped ends of the housing.

(9) Spread the housing, and remove the heat exchanger.

b. Installation.

(1) Position the housing on the heat exchanger.

(2) Install the two end screws.

(3) Position the heat exchanger assembly in the heater.

(4) Connect the heat exchanger exhaust tube outlet to the extension.

(5) Install the overheat switch.

(6) Install the thermostat control switch, and tighten the attaching screws.

(7) Connect the electrical wires to the switch.

(8) Connect the control cable to the switch.

(9) Install the combustion air tube.

23-10. Upset Switch.

a. Removal.

(1) Disconnect the electrical wire.

(2) Remove the attaching screw.

(3) Remove the switch.

b. Installation.

(1) Position the switch, and install the attaching screw.

(2) Connect the electrical wire.

CHAPTER 24

ARCTIC WINTERIZATION EQUIPMENT

Section I. GENERAL

24-1. Scope.

This chapter contains information for the maintenance of the arctic winterization components installed on certain M880, M882, M884, and M886 trucks.

24-2. Description.

Arctic winterization equipment installed on a M880-series truck permits operation of the vehicle in extreme cold weather conditions. Use of the "Swingfire" heater will aid in starting your vehicle, even if cold-soaked, down to a temperature of -50° Farenheit (-46° Centigrade). A heavy-duty heater motor and core replace the standard units for heating the cab area. An M880 or M882 truck will have the cargo area reworked to accommodate a 24 volt personnel heater with insulated structure installed to protect personnel. The M886 ambulance 12 volt personnel heater will be replaced with a 24 volt personnel heater. All winterized vehicles have wide-tread snow tires and tubes installed. Refer to figure 24-1 for arctic equipment components location.

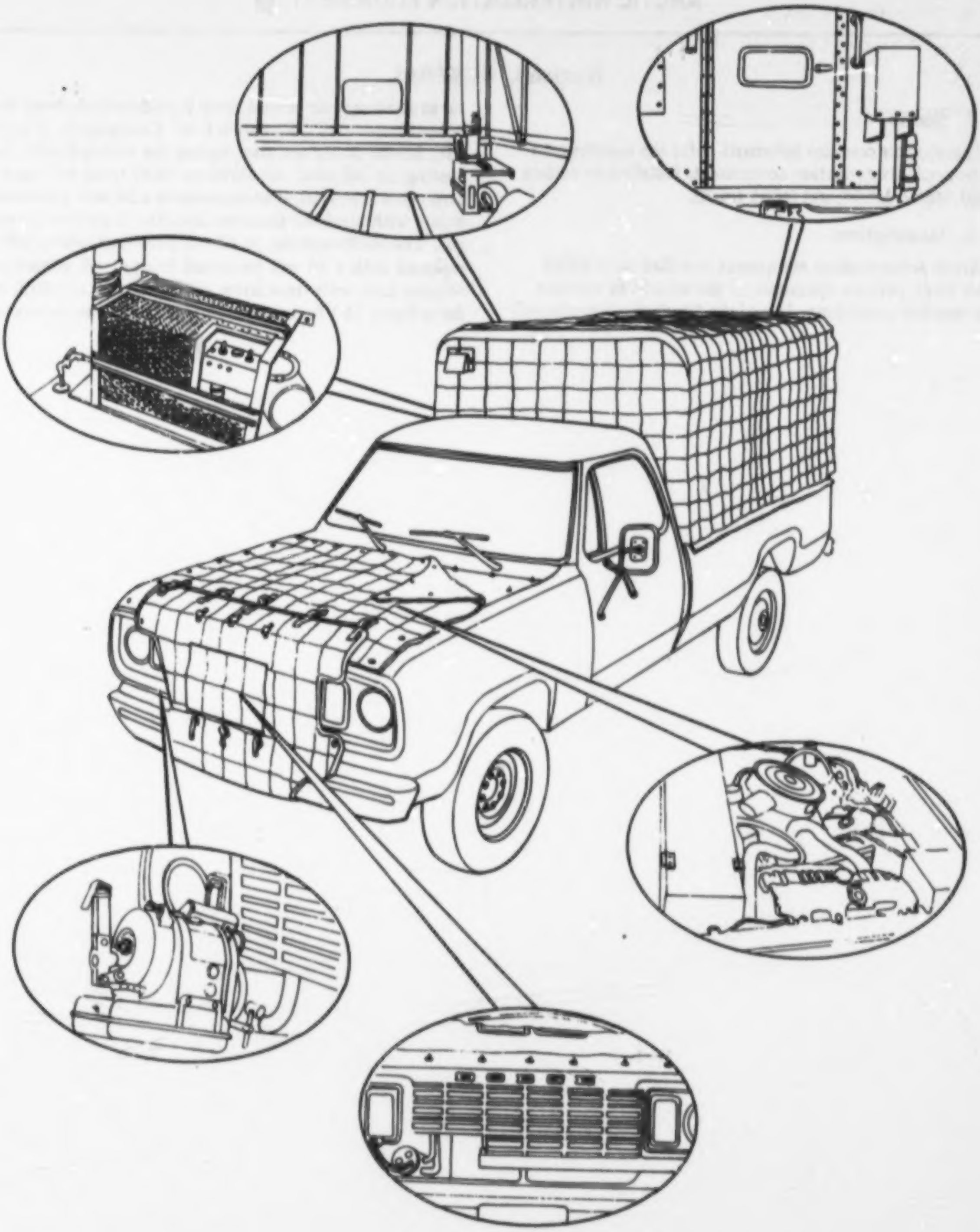


Figure 24-1. Arctic Kit Components Location.

Section II. THOUBLESHOOTING

24-3. Swingfire Heater.

Table 24-1 presents troubleshooting data for the Swingfire heater.

Table 24-1. Swingfire Heater Troubleshooting

Type of Trouble	Reason	Remedy
DOES NOT START		
Membrane valve	a. Valve dirty	Clean membrane valve.
	b. Membrane sticks	Repair damaged membrane.
	c. Membrane damaged	Keep interior of housing clean. When Swingfire is operating keep cover closed. Do not remove rubber plug at the side of housing. Dirt could enter here.
Mixing chamber	Mixing chamber clogged	Clean mixing chamber, preheating plug, and spark plug.
Possible leaks	a. Tank cover or cover over main filter leaks	Tighten tank cover or main filter cover or replace gaskets if necessary.
	b. Main filter cover leaks	Tighten main filter cover. Replace gasket if necessary.
	c. Air valves leak	Clean air valves, check gaskets, and replace damaged gaskets.
	d. Control air shut-off valve leaks or is stuck.	Dismantle and clean valve, replace gasket if necessary. When pushing the pressure pin in, it must bounce back.
	e. Air lines leak	Check connections and replace gaskets where necessary.
	f. Fuel lines leak	Tighten connections and replace gaskets where necessary.
	g. Carburetor leaks at mixing chamber	Tighten carburetor screws.
	h. Diaphragm air pump fails	Remove pump and repair.
Lack of fuel supply	Main fuel filter dirty	Remove and clean filter.
Lack of current (no humming sound when igniting)	a. No current available from vehicle battery.	Check 24 volt battery system.
	b. Circuit breaker not working.	Replace circuit breaker.
	c. Plug is not properly grounded	Ground plug.
	d. Defective cable	Repair or replace cable.
	e. Defective plug	Replace plug.
	f. On/off switch defective	Replace switch.
	g. Electric connections loose	Tighten connections.
	h. Broken cable	Replace cable.
	i. Cable from condenser broken off at fastening screw	Replace condenser.
	j. Points are oxydized or burnt	Clean points.
	k. Vibrator starting coil damaged	Replace coil.
Lack of ignition (humming tone audible)	a. Spark plug clogged or damaged	Clean or replace spark plug.
	b. Ignition cable plug damaged	Replace plug.
	c. Ignition cable damaged	Replace cable.

Table 24-1. Swingfire Heater Troubleshooting-Continued

Type of Trouble	Reason	Remedy
HARD TO START		
	a. Diaphragm valve dirty or clogged; diaphragm sticks	Clean diaphragm valve.
	b. Spark plug electrodes distance incorrect	Adjust distance of electrodes to 1-1.2 mm.
	c. Preheating plug clogged or defective (important at temperatures below 30° F (-1° C))	Clean preheating plug or replace.
SPUTTERS		
	a. Fuel line clogged	Blow out fuel line with compressed air; clean fuel tank.
	b. Regulator valve clogged or defective	Remove and dismantle regulator valve, clean and check, replace gaskets, and reinstall, if serviceable.
	c. Atomizing nozzle dirty	Remove, dismantle, clean, and check carburetor, replace gaskets, and reinstall the nozzle.
	d. Diaphragm valve dirty or diaphragm damaged	Remove, clean, or replace diaphragm.
CONTINUES TO RUN IN SPITE OF CLOSED FUEL REGULATOR KNOB	Fuel regulator valve damaged	Remove and disassemble fuel regulator valve, clean and check, replace damaged parts, and reinstall the valve.

24-4. Personnel Heater Troubleshooting.

Table 24-2 presents troubleshooting data on the personnel heater assembly, the electrical control box, fuel filter, fuel pump, and electrical cabling.

Table 24-2. Personnel Heater Troubleshooting

Type of Trouble	Reason	Remedy
FAILS TO START OR OUTPUT TOO LOW		
Insufficient fuel or no fuel	a. Shut-off cock not open	Place handle in open position.
	b. Fuel filter	Clean or replace as required.
	c. Fuel pump	If inoperable, replace.
	d. No fuel	Fill fuel tank.
	e. Fuel line leaks	Tighten or replace.
Insufficient or no current to heater	a. Low voltage	Recharge or replace battery.
	b. Loose wiring harness connections	Tighten.
Incorrect operations of heater controls	a. Poor wire connections	Tighten all connections. Check for correct operation at control box.
	b. HI-LO switch	Place switch in HI position; if output still too low, check and replace if necessary (1) control box, (2) fuel control valve, or (3) fuel pump.

Table 24-2. Personnel Heater Troubleshooting-Continued

Type of Trouble	Reason	Remedy
OVERHEATS AND STOPS OPERATING		
Overheats	a. Resistricted or defective exhaust	Remove restriction; clean heater combustion chamber.
	b. Fuel control valve	Replace control valve.
	c. Flame detector switch	Replace flame detector switch.
	d. Overheat switch	Replace switch assembly.
Stops burning	a. Insufficient air	Check air intake and remove any restrictions.
BLOWER OPERATES BUT NO IGNITION	a. Defective igniter	Test in accordance with paragraph 24-22*f*. Replace if necessary.
	b. Defective ignition control	Test in accordance with paragraph 24-22*f*. Replace if necessary.
	c. Clogged orifice	Clean or replace orifice.
	d. Clogged fuel line	Clean fuel lines.
	e. Clogged fuel filter	Clean or replace.
	f. Defective fuel pump	Replace.
	g. Low voltage	Test in accordance with paragraph 24-22*f*.
BLOWER DOES NOT OPERATE	a. No current	Check electrical connections.
	b. Defective motor	Replace motor.

24-5. Cab Heavy-duty Heater Troubleshooting.

The cab heater/defroster is identical to the standard heater except for a heavy-duty motor and core. Table 24-3 presents troubleshooting data for the complete heater/defroster.

Table 24-3. Cab Heavy-duty Heater

Type of Trouble	Reason	Remedy
INSUFFICIENT HEAT	a. Insufficient coolant in cooling system	Add coolant to cooling system.
	b. Collapsed coolant outlet hose or plugged inlet hose	Replace hose.
	c. Air in heating system	Added coolant to cooling system.
	d. Hose connections crossed	Connect hose to proper position.
	e. Blower motor inoperative	Check and replace fuse if necessary. Inspect wiring and connection. Replace or tighten if required.
	f. Low engine temperature	See engine diagnosis in chapter 2, figure 2-2.
TOO MUCH HEAT	a. Water valve inoperative or improperly adjusted	Replace water valve or adjust control cable as necessary.
	b. Disconnected or broken boden cable	Replace or connect boden cable as necessary.
	c. Engine thermostat	Replace thermostat.
BLOWER MOTOR NOT OPERATING	a. Blown fuse	Replace fuse.
	b. Faulty electrical connection	Tighten connections.
	c. Faulty blower switch	Replace blower switch.
	d. Faulty blower motor	Replace blower motor.
	e. Faulty resistor	Replace resistor.

Section III. REPAIR

24-6. Water Jacket Modification.

If water jacket assembly requires replacement, the new water jacket must be modified. Use a hacksaw to remove 1/2 inch of metal from outlet closest to cover opening. Use replaced water jacket as a guide.

24-7. Winterization Coolant Hoses and Tubes.

Replace any cracked, swollen, or restricted hoses or tubes.

24-8. Battery Boxes, Arctic, 12 Volt and 24 Volt.

a. Removal.

(1) Remove battery box cover.

(2) Disconnect the battery cables, and remove the battery.

(3) Disconnect flexible hose from battery box.

(4) Remove attaching hardware from box.

(5) Remove the battery box.

b. Installation.

(1) Position the battery box in proper location of engine compartment, and secure with attaching hardware.

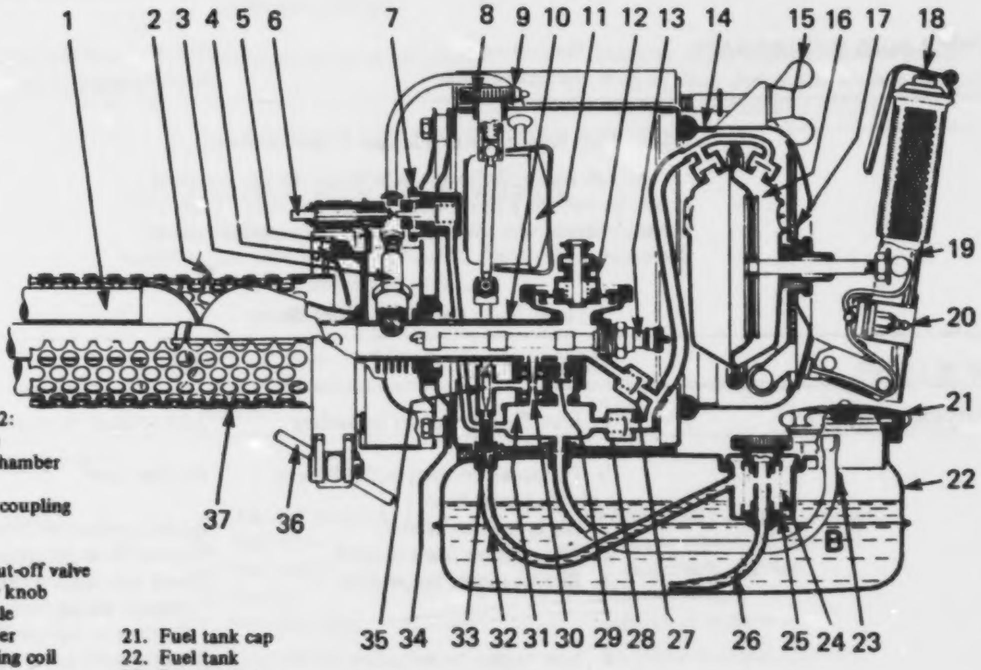
(2) Connect flexible hose to battery box.

(3) Install battery and connect battery cables.

(4) Install battery box cover.

24-9. Swingfire Heater.

The Swingfire heater is a component of the Arctic Winterization Kit that is not attached to the truck. Therefore the Swingfire heater may be removed and repaired without disassembly of any part of the truck. Figure 24-2 gives a cross section of the Swingfire heater assembly.



Legend for Figure 24-2:

1. Pulsation pipe
2. Combustion chamber
3. Spark plug
4. Quick change coupling
5. Gasket
6. Pressure pin
7. Control air shut-off valve
8. Fuel regulator knob
9. Carrying handle
10. Mixing chamber
11. Vibrator starting coil
12. Diagram valve
13. Preheating plug
14. Cover
15. Wing nut
16. Diaphragm air pump
17. Air openings
18. Ignition switch
19. Hand pump lever
20. Starting cable connector
21. Fuel tank cap
22. Fuel tank
23. Return pipe
24. Main fuel filter
25. Gasket ring
26. Fuel line
27. Air valve (mixing chamber)
28. Air valve (carburator)
29. Throttle
30. Atomizing nozzle
31. Carburator
32. Fuel line
33. Cartridge filter
34. Heat shield
35. Regulator valve
36. Wing nut
37. Perforated mantle pipe

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Figure 24-2. Swingfire Heater Components-Cutaway View.

24-10. Mixing Chamber Air Valve.

a. Removal.

(1) Loosen heater cover wing screw to open cover.

(2) Remove fuel lines connector fittings on mixing chamber.

(3) Remove preheating plug.

(4) Remove diaphragm valve.

(5) Remove lower valve and gasket.

b. Repair.

(1) Disassemble valve by removing locking nut and upper valve which is under spring tension.

(2) Clean all components.

(3) Inspect for damaged threads, and worn or damaged gaskets. Replace as necessary.

(4) Reassemble air valve.

c. Installation.

(1) Install lower valve and gasket at mixing chamber port.

(2) Install diaphragm valve.

(3) Install preheating plug.

(4) Connect fuel lines.

(5) Close heater cover and secure by tightening wing screw.

24-11. Carburetor Air Valve.

a. Removal.

(1) Loosen heater cover wing screw to open cover.

(2) Remove hose from top of air valve.

(3) Remove lower valve and gasket.

b. Repair.

(1) Disassemble air valve by removing lock nut and upper valve which is under spring tension.

(2) Clean all components.

(3) Inspect for damaged threads, and worn or damaged gaskets. Replace as necessary.

(4) Reassemble air valve.

c. Installation.

(1) Install lower valve and gasket.

(2) Install hose to top of air valve.

(3) Close heater cover and secure by tightening wing screw.

24-12. Control Air Shut-off Valve.

a. Removal.

(1) Remove quick coupling assembly.

(2) Remove air shut-off valve with gasket and spring from tube port.

b. Repair.

(1) Disassemble the valve.

(2) Clean all parts.

(3) Replace gaskets if damaged or worn.

(4) Reassemble the valve.

c. Installation.

(1) Place spring and gasket in tube port.

(2) Install control air shut-off valve. Check proper function of valve by pressing against valve pin. Pin must bounce back.

(3) Install quick coupling assembly.

24-13. Air Pump Diaphragm Assembly.

a. Removal.

(1) Loosen heater cover wing screw to open cover.

(2) Disconnect electrical leads from preheating plug, condenser, and housing.

(3) Disconnect hose from mixing chamber air valve.

(4) Remove heater cover assembly, air pump diaphragm and handle assembly as a unit.

(5) Remove mounting hardware of air pump diaphragm assembly.

b. Repair.

(1) Disassemble diaphragm.

(2) Inspect all parts for damage and wear. Replace components as necessary.

(3) Clean all components.

(4) Reassemble diaphragm.

c. Installation.

(1) Secure air pump diaphragm assembly with mounting hardware.

(2) Install heater cover assembly, air pump diaphragm and handle assembly as a unit.

(3) Connect hose to mixing chamber air valve.

(4) Connect electrical leads to preheating plug, condenser, and housing.

(5) Close heater cover and tighten wing screw.

24-14. Regulator Valve Assembly.

a. Removal.

(1) Insure that regulator valve is closed by turning fuel and air mix knob fully clockwise.

(2) Loosen heater cover wing screw to open cover.

(3) Push joint shaft up into recessed bottom of fuel and air mix knob, to remove joint shaft from valve slot.

(4) Remove hollow screw with gaskets that secures fuel suction hose assembly to fuel tank.

(5) Remove nut at lower end of regulator valve.

(6) Remove fitting connector of fuel suction hose, gaskets, and spacer.

(7) Remove valve as a unit from carburetor port.

b. Repair.

(1) Disassemble valve.

(2) Disassemble fuel suction hose assembly.

(3) Clean all parts.

(4) Inspect filters for broken wire mesh and other damage.

(5) Replace damaged or worn parts.

(6) Reassemble valve.

(7) Reassemble fuel suction hose assembly.

c. Installation.

(1) Install valve on carburetor port.

(2) Install fuel suction hose, gaskets, and spacer. Secure these parts to lower end of regulator valve with nut.

(3) Connect fuel suction hose assembly to fuel tank with hollow screw.

(4) Position joint shaft in valve slot.

(5) Close heater cover and tighten wing screw.

24-15. Carburetor Assembly.

a. Removal.

(1) Loosen heater cover wing screw to open cover.

(2) Disconnect fuel and air lines from carburetor.

(3) Remove rubber plugs from side of heater housing.

(4) Insert allen wrench through holes of heater housing to remove screws that mount carburetor to mixing chamber.

(5) Remove carburetor.

b. Repair.

(1) Disassemble carburetor.

(2) Clean all components.

(3) Replace any worn or damaged parts.

(4) Reassemble carburetor.

c. Installation.

(1) Position carburetor against side of mixing chamber and secure with mounting screws.

(2) Install rubber plugs in side of heater housing.

(3) Connect fuel and air lines to carburetor.

(4) Close cover and tighten wing screws.

24-16. Condenser Assembly.

a. Removal.

(1) Loosen heater cover wing screw to open cover.

(2) Push aside wire springs on cover of starting coil. Remove cover.

(3) Loosen mounting screw of inside lower corner of starting coil.

(4) Disconnect electrical leads of condenser.

(5) Remove condenser.

b. Test.

(1) Check condenser with a multimeter for continuity and constant non-fluctuating current. Replace if necessary.

c. Installation.

(1) Position condenser in retaining clamp and secure by tightening mounting screw.

(2) Connect electrical leads of condenser.

(3) Reinstall starting coil cover and secure by repositioning wire springs in place.

(4) Close cover and tighten wing screw.

24-17. Circuit Breaker.

a. Test.

(1) Determine that the 24 volt battery system is operating (see TM 9-2320-266-20).

(2) Place red lead of voltmeter at point where power cable connects to circuit breaker. Ground black lead of voltmeter to bare metal surface and check for 24 volt output. Replace circuit breaker if there is no reading.

b. Removal.

(1) Disconnect cable from circuit breaker.

(2) Remove circuit breaker.

c. Installation.

(1) Place circuit breaker in position and secure to cable.

24-18. Quick Change Coupling.

Check wing nut and thread. Replace gasket if worn or damaged.

24-19. Main Fuel Filter.

a. Removal.

(1) Loosen the fuel tank cap to relieve any air pressure that may be in the fuel system.

(2) Remove filter cover.

(3) Remove filter element, and clean filter element with compressed air. Replace if necessary.

(4) Inspect gasket. Replace if damaged or worn.

b. Installation.

(1) Position filter element in fuel tank and secure with filter cover.

(2) Tighten fuel cap.

24-20. Diaphragm Valve.

a. Removal.

(1) Loosen heater cover wing screw to open cover.

(2) Unscrew wheel and remove diaphragm valve.

b. Repair.

(1) Remove spring pin to disassemble valve.

(2) Clean all components.

(3) Inspect for worn or damaged parts. Replace if necessary.

(4) Reassemble diaphragm valve.

c. Installation.

(1) Position valve on valve shaft and secure valve by tightening wheel. Insure that the adjusting bracket is set to "+" position.

(2) Close cover and tighten wing screw.

24-21. Cab Heater Motor and Core, Heavy-duty.

Refer to TM 9-2320-266-20 for removal and installation of cab heater.

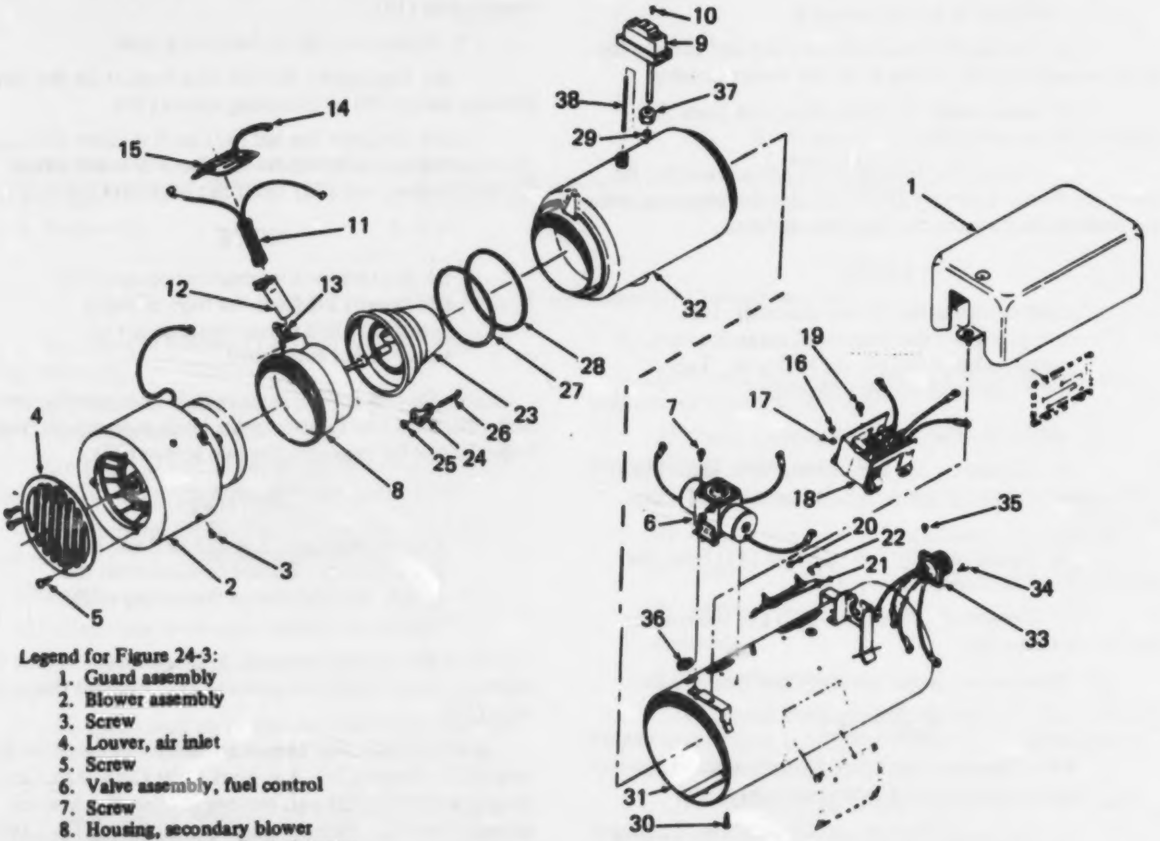
24-22. Personnel Heater, Cargo Area.

a. Removal.

(1) Remove 24 volt battery system ground cable.

(2) For the M881 or M882 vehicle, gain access to heater by removing screws and nut retaining guard. Remove guard. For the M886 ambulance, access is gained in same way as for heater/ventilator (refer to TM 9-2320-266-20).

(3) Turn off shutoff cock.



Legend for Figure 24-3:
1. Guard assembly
2. Blower assembly
3. Screw
4. Louver, air inlet
5. Screw
6. Valve assembly, fuel control
7. Screw
8. Housing, secondary blower
9. Switch assembly, flame detector
10. Screw
11. Igniter assembly
12. Igniter tube and bracket assembly
13. Tube assembly, fuel
14. Lead, ground
15. Cover assembly, hatch
16. Nut
17. Washer, lock
18. Control, ignition
19. Screw
20. Nut
21. Switch assembly, overheat
22. Screw
23. Burner assembly
24. Clamp, burner
25. Nut
26. Bolt, hook
27. Packing, preformed
28. Gasket
29. Sleeve, 1/4 in. tube
30. Screw
31. Housing assembly, heater
32. Exchanger, heat
33. Receptacle, cable
34. Screw
35. Screw
36. Grommet
37. Nut
38. Rod, ceramic

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Figure 24-3. Personnel Heater Assembly Components.

WARNING

Do not allow sparks or flame near work area.

(4) Disconnect fuel line at adapter.

(5) Remove electrical power convertor to personnel heater.

(6) Remove clamps securing heater to base plate.

(7) Loosen clamp and bottom adapter attached to heater.

(8) Loosen clamp securing exhaust tube to heater.

(9) Carefully remove heater with attached adapters.

(10) Remove adapters.

b. *Disassembly.* Refer to figure 24-3.

(1) Removal of blower assembly.

(a) Release the two stud fasteners and remove the guard assembly (1) by lifting it off the heater housing.

(b) Disconnect the motor lead wire from the flame detector switch (9).

(c) Loosen the four bayonet slot screws (3). Remove the blower assembly (2) by turning the blower assembly counterclockwise to free the bayonet slots.

NOTE

After removing the blower assembly, take care to remove the grommet (36) in the housing around the blower lead wire. Tag lead as required for identification.

(2) Removal of fuel control valve.

(a) Disconnect the fuel control valve leads from the overheat switch (21) and from the terminal of receptacle (33).

(b) Disconnect the fuel tube nut (13) from the outlet of the fuel control valve (6).

(c) Remove the four screws (7) and remove the fuel control valve (6).

(3) Removal of igniter assembly and igniter tube.

CAUTION

When disconnecting leads do not break leads loose from the igniter assembly.

(a) Disconnect the igniter leads from the ground terminal and from the ignition control (18). Release the screws and remove the hatch cover (15).

(b) Remove the igniter assembly (11) by twisting it to disengage lug from slots. When the igniter is cleared, remove it (by hand) from the igniter tube (12).

(c) Remove screw (19) and remove the igniter tube (12) by lifting it out of its emplacement.

(4) Removal of fuel tube assembly. Remove the fuel tube assembly (13) by releasing the compression nut on the fuel inlet of burner (23).

(5) Removal of secondary blower housing. Remove secondary blower housing (8) by lifting it off the heat exchanger.

(6) Removal of ignition control unit.

(a) Disconnect motor lead wire, shut off and restriction solenoid lead wires, and heating element lead wires out of retaining loop on side of ignition control unit.

(b) Disconnect the two ground leads from terminal head nut (16). Disconnect the two leads (14) off of flame detector switch (9) and the one lead from the overheat switch (21).

(c) Remove the lead off the ignition control (leading from igniter assembly).

(d) Remove the three screws (19) and the ignition control unit (18).

(7) Removal of flame detector switch.

(a) Disconnect the five wire leads from the flame detector switch (9) by removing screws (10).

(b) Unscrew the nut (37) until it clears the threads and carefully remove the flame detector switch (9) and ceramic rod (38) from the heat exchanger (32).

NOTE

Do not remove the compression nut (37) and sleeve (29) from the tube of flame detector switch unless replacement of sleeve or nut is required.

(8) Removal of overheat switch. Remove the overheat switch (21) by disconnecting leads at terminals Nos. 9 and 30 and by removing the two screws (22).

CAUTION

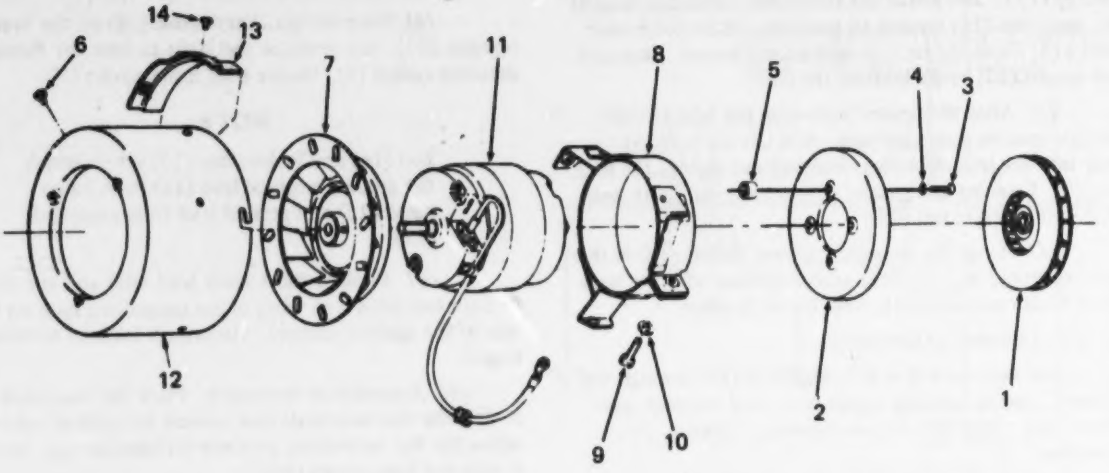
The overheat switch is adjusted and sealed at the factory. Do not bend or twist the switch. Do not change the setting of the adjustment screw.

(9) Removal of receptable. Disconnect the four lead wires and remove the four screws (34). Remove the receptacle (33).

(10) Removal of burner assembly. Remove the five nuts (25), clamps (24), and hook-bolts (26). Lift the burner assembly (23) and remove it from the heat exchanger housing. Remove preformed packing (27) and gasket (28).

(11) Removal of heater housing. Remove the screws (30). Spring the housing just enough to clear the exhaust tube; separate the heat exchanger (32) and remove the heater housing (31).

(12) Blower assembly. Refer to figure 24-4.



Legend
1. Wheel assembly, combustion blower
2. Header, secondary blower
3. Screw
4. Washer, lock
5. Spacer
6. Screw
7. Wheel assembly, blower
8. Bracket assembly, motor mounting
9. Screw
10. Washer
11. Motor (24 vdc)
12. Housing assembly
13. Baffle, vent air
14. Screw

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Figure 24-4. Ventilating Blower Assembly Component Parts.

(a) Remove housing (12) from bracket (8) by removing screws (6).

(b) Remove combustion blower wheel assembly (1) by loosening setscrew in hub.

(c) Remove blower header (2) from motor (11) by removing screws (3), washers (4), and spacers (5).

(d) Remove blower wheel assembly (7) from blower motor (11) by loosening setscrew in hub.

c. *Cleaning.*

(1) Clean heat exchanger as follows:

(a) Scrape as much carbon as possible out of heat exchanger.

(b) Clean heat exchanger by soaking in a suitable solvent. Rinse to remove all traces of solvent and dry thoroughly.

(2) Clean burner assembly by scraping out all soot and carbon from inside the casting and burner surfaces.

(3) Clean air valve assembly by removing all carbon and grease outside of valve.

(4) Clean overheat switch contacts by sliding a clean strip of bond paper between points.

CAUTION

Do not use an abrasive on switch contacts. Do not attempt to bend the blade or contact arm or change the setting of the adjusting screws.

d. *Inspection and Repair.*

(1) Check wiring for condition of insulation and tightness of electrical connectors.

(2) Check electrical wires and terminal connections for continuity, using an ohmeter.

(3) Inspect heat exchanger for damage or leaks.

(4) Inspect scoop on burner assembly for distortion.

(5) Inspect overheat switch assembly for damage.

(6) Replace all defective parts.

e. *Assembly.*

(1) Blower assembly.

(a) Install blower wheel assembly (7, fig. 24-4) on blower motor (11) and tighten setscrew. Position motor through mounting bracket (8).

(b) Install blower header (2) to motor (11) with spacers (5), washers (4), and screws (3).

(c) Install blower wheel assembly (7) by tightening setscrew in hub.

(d) Install housing (12) to bracket (8) with screws (6).

(2) Assembly of burner.

(a) Install new preformed packing ring (27, fig. 24-3) and gasket (28) over the burner end of the burner assembly (23).

(b) Place the burner assembly (23) in the heat exchanger (32), and install the four hook-bolts (26), clamps (24), and nuts (25) loosely in position. Slide the heater housing (31) over the heat exchanger and burner. Reinstall three screws (30) in the housing lap joint.

(c) Aline the igniter pocket on the burner with the large opening in the housing. Seat the burner (23) firmly into the heat exchanger housing and tighten the four nuts (25). Connect the ground strap to nearest clamp and secure with another nut (25).

(d) Insert the secondary blower housing (8) in the burner assembly and aline the access opening with the large hole of heater housing (31). Seat firmly in place.

(3) Assembly of fuel tube.

(a) Insert the fuel tube assembly (13) through the secondary blower housing access tube, and connect compression nut onto the burner bushing. Secure the connection.

(b) Insert the igniter assembly tube (12) into the igniter chamber and secure with screw (19).

(4) Assembly of igniter assembly.

(a) Install the igniter assembly (11) by pressing against the spring to engage the bayonet fastener.

(b) Reposition the hatch cover (15) and secure with screws.

(5) Assembly of blower.

(a) Thread the blower wire through the hole in the heater housing and install the grommet (36). Place the blower assembly (2) in the blower housing (8) and slide the slots under the four screws (3).

(b) Secure the blower assembly (2) to the housing with the four screws (3).

(c) Connect the motor lead wire to the flame detector switch (9).

NOTE

Assemble with baffle at top.

(6) Assembly of overheat switch. Install the overheat switch (21) into the heater housing (31) and secure with the two screws (22).

NOTE

The adjusting screw is located toward the blower end of the heater.

(7) Assembly of flame detector switch.

(a) Insert the flame detector switch (9) into the heat exchanger (32). Position the adjustment screw above the overheat switch.

(b) Secure the switch with nut (37) over sleeve (29).

(c) Replace the five lead wires to the flame detector switch (9) and reconnect the wire leads as tagged to the overheat switch (21). Secure with screws (10).

(8) Assembly of ignition control.

(a) Place the ignition control (18) on the heater housing (31), and position the leads to face the flame detector switch (9). Secure with three screws (19).

NOTE

Nut (16) and lockwasher (17) are to attach the ground terminal lead (14) from hatch cover (15) and ground lead from receptacle (33).

(b) Replace the blower lead wire and the three fuel control valve lead wires in the supporting loop on the side of the ignition control. Reconnect leads to terminals as tagged.

(9) Assembly of receptacle. Place the receptacle (33) so that the lead terminals face toward the control valve (6) with pilot bar on bottom or screw terminal at top. Secure it with the four screws (34).

(10) Assembly of fuel control valve.

(a) Position the fuel control valve (6) with the thermostat facing toward the ignition control (18). Secure the fuel control valve with the four screws (7).

(b) Connect the igniter fuel tube (13) to the control valve (6) and secure the fitting with nut.

(c) Thread the blower wire under the fuel valve.

(d) Thread the three fuel control valve lead wires through the supporting loop on the side of the ignition control and reconnect leads to terminals as tagged.

(11) Connections.

(a) Place the lead wires as tagged for the fuel control valve and connect the ground (14) and ground from receptacle (33) to the ground terminal head and secure with nut (16).

(b) Refer to schematic diagram on inside of guard assembly (1) and insure the connections are correct.

f. Test.

(1) Install heater on a suitable test stand. Connect a flowmeter between fuel pump and heater assembly and attach a shut-off valve near the outlet end of the fuel line. Make electrical and exhaust connections (fig. 24-5). Do not connect the fuel line to heater.

(2) Connect a voltmeter between the screw terminal of the igniter and ground. Set meter on a low range (0 to 15 volts).

(3) Using an adjustable source of 24 volts dc, preset voltage control to 20 volts dc and snap heater control switch to ON position. The heater blower must start and run throughout this test to cool the transistor.

(4) Reset the applied voltage to 19.5 to 20.5 volts and note voltage at the igniter terminal. It must be at least 5.8 but no more than 6.3 volts dc.

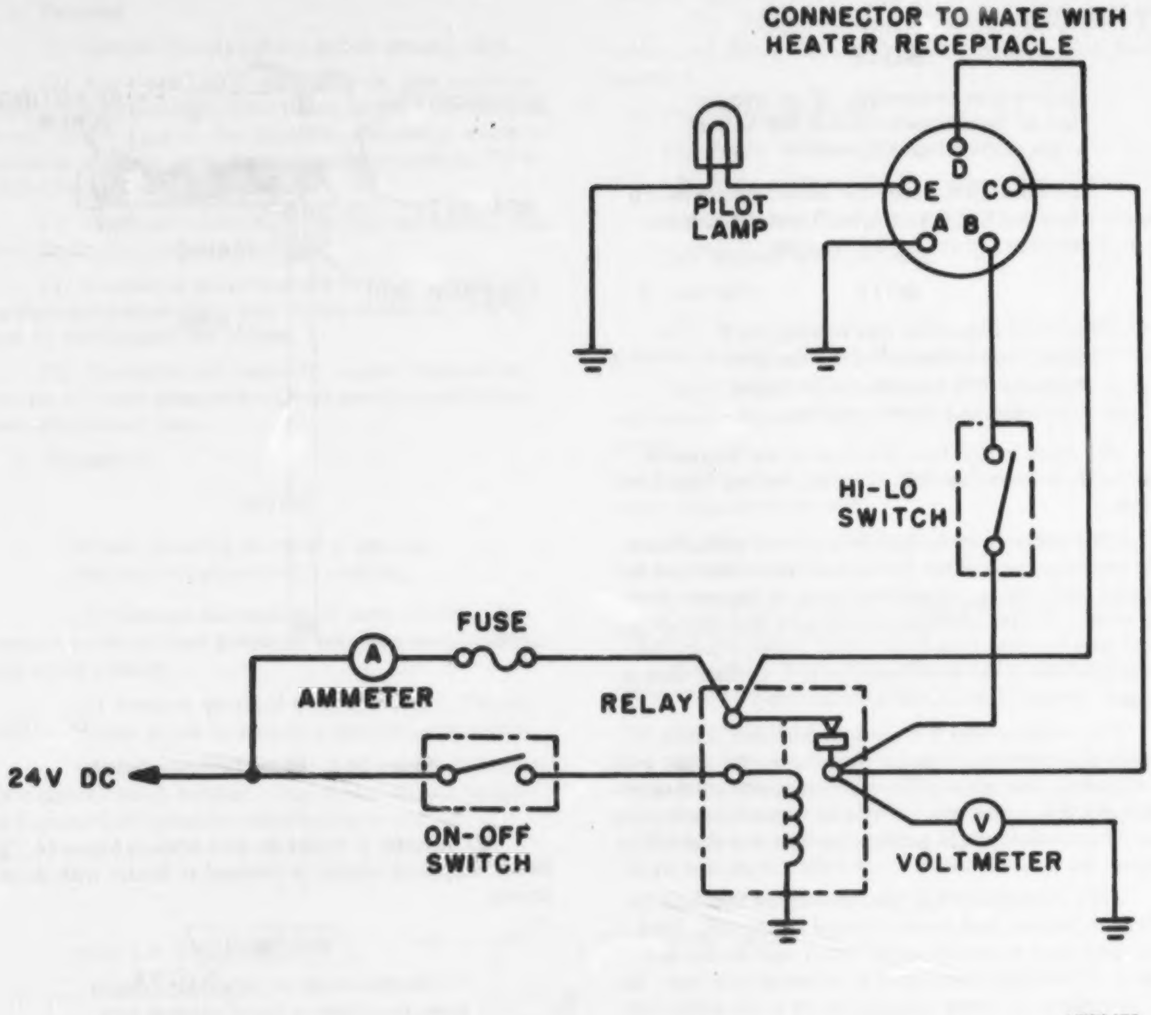

CONNECTOR TO MATE WITH HEATER RECEPTACLE
D
E
C
A
B
PILOT LAMP
HI-LO SWITCH
FUSE
A
AMMETER
RELAY
24V DC
ON-OFF SWITCH
V
VOLTMETER
AT33458

Figure 24-5. Personnel Heater Test Wiring Setup.

CAUTION

Do not prolong this test more than 3 minutes since the igniter and transistor are not designed for continuous service under these voltage and current conditions.

(5) If igniter voltage is not within limits, replace the entire ignition control.

(6) Connect the fuel line to heater. The heater must be mounted in the same position it normally occupies in the vehicle, since the mounting position affects the fuel flow through the control valve.

(7) Preset voltage control by trial and error so that voltage will be 24 volts dc with the full starting load of the heater. The test will not be valid unless starting voltage is within limits, since ignition time is affected by voltage.

(8) With the above conditions established set the HI-LO switch to LO, and then turn heater control switch to ON. Start timing heater operation from the instant the switch is turned on.

(a) Current draw must not exceed 16 amperes.

(b) Note fuel flow during the starting cycle. Flow must be more than 0.010, but less than 0.014 lb/min.

(c) The heater should ignite within 40 seconds.

(d) The flame detector switch must transfer within 150 seconds from the moment the heater control switch was turned on.

NOTE

Ignition may be inaudible. If so, transfer time of flame detector switch will be used as the limiting factor for test.

(e) Immediately after the flame detector switch transfers, turn the HI-LO switch to HI and note current draw. Draw must not exceed 6.3 amperes.

NOTE

Add 3.5 amperes to maximum current draw if test is conducted at a temperature that will maintain the fuel valve thermostat in a closed position.

(9) Observe high heat fuel flow on the flowmeter. Flow must be more than 0.027 lb/min., but less than 0.033 lb/min.

(10) If fuel rates for high heat are not within limits, turn adjusting screw of the fuel control valve clockwise to increase fuel flow, or counterclockwise to decrease flow and retest. If, after adjusting fuel flow for high heat, it is found that low heat flow is not within limits, it is an indication that one of the metering holes in the orifice plate is clogged. Replace fuel control valve assembly.

(11) While heater is burning on high heat, block off all flow of ventilating air by covering the heater outlet with cardboard or sheet metal. The overheat switch must open and shut off fuel flow in more than 15 seconds, but less than 30 seconds from the moment air flow was shut off. Replace the overheat switch if not within limits and retest.

(12) After heater has been burning on high heat for at least 1 minute, turn heater control switch off. Fuel flow must drop to zero for more than 1 minute, but less than 3-1/2 minutes, and must then automatically stop. Reset, or replace, the flame detector switch if not within limits and retest.

(13) To time the blower, mark the combustion air blower fan with chalk. Start the heater and time the fan with a suitable tachometer. Blower speed must be within the limits of 6,800 to 7,800 rpm with restriction on the heater outlet and an applied voltage of 24 volts.

h. Adjusting Flame Detector Switch. Refer to figure 24-6.

(1) Back off on the adjusting screw until the microswitch clicks (or one full turn).

(2) Turn adjusting screw slowly in until the switch clicks, then turn exactly 3/4 turn past the click point.

(3) Cement adjusting screw in place with Glyptal varnish or suitable substitute.

i. Installation.

(1) Position adapter on heater hot air outlet and secure with four screws and washers.

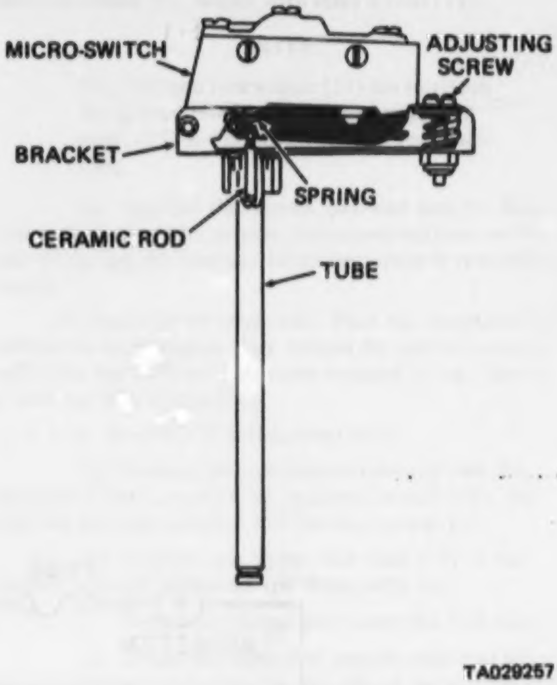


Figure 24-6. Flame Detector Switch.

(2) Adapter at heater air inlet replaces louver (4, fig. 24-3). Replaced adapter is retained to heater with three screws.

WARNING

To prevent escape of poisonous exhaust gases, be certain to install exhaust tube retaining clamps securely when performing the following steps.

(3) Position heater on base plate. For the M880 or M882 vehicle, secure heater to exhaust tube by tightening clamp. For the M886 ambulance, secure heater to flexible exhaust tube and secure with clamp.

(4) Secure heater to base plate with two adjustable hose clamps. For the M880 or M882, secure hose duct to adapter with clamp.

(5) Connect power cable connector to heater.

(6) Install adapter and connect fuel line to heater.

(7) Install heater guard.

(8) For the M880 or M882, install guard. For the M886 ambulance, install adapter and cover plate.

(9) Connect battery ground cable.

(10) Turn on shutoff cock.

24-23. Personnel Heater Control Box.

a. Removal.

(1) Remove 24 volt battery system ground cable.

(2) For the M880 or M882 vehicle, gain access to control box by removing three screws and one nut retaining guard. Remove guard. For the M886 ambulance, access is gained in same way as for heater/ventilator (refer to TM 9-2320-266-20).

(3) Disconnect electrical connector and harness plug from heater control box assembly.

(4) If repair or maintenance is to be performed only on electrical components, remove two screws and remove unit by sliding panel out of case.

(5) If control box assembly requires replacement, remove two nuts along with washers securing control box assembly to base plate.

b. Disassembly.

NOTE

Before removing electrical wiring, tag wire and component with location.

(1) Remove electrical wires from switches. Disconnect switches from panels by removing nuts, washers, and keyed washers.

(2) Remove electrical wires from lamp. Disconnect lamp from panels by removing lens, nut, and washer.

(3) Remove electrical wiring from circuit breaker. Disconnect circuit breaker. Disconnect circuit breaker and spacer from panel by removing screw and nut.

(4) Disconnect bracket by removing screw. Disconnect cable assembly from bracket by removing screw.

(5) Disconnect shell from cable by removing washer and sliding shell from cable. Remove cable from grommet.

c. Inspection and Repair.

(1) Repair defective wiring.

(2) Reform distorted parts (refer to TM 10-450).

(3) Weld cracks (refer to TM 9-237).

(4) Replace defective parts.

d. Assembly.

(1) Insert grommet on cable, and insert cable and grommet in panel. Slide shell on cable and install washer.

(2) Connect cable assembly to bracket and secure with screw. Connect bracket to panel and secure with screws.

(3) Connect circuit breaker and spacer to panel, and secure with screw and nut.

(4) Position lamp through panel and secure with nut and washer. Install lens.

(5) Position switches through panels and secure with nuts, washers, and keyed washers.

(6) Install electrical wiring in accordance with tag designations or refer to figure 24-7.

e. Installation.

(1) If repair or maintenance was performed only on control box electrical components (para. *a(4)* above), position assembled electrical components in case and secure with two screws. Proceed to step *(5)* below.

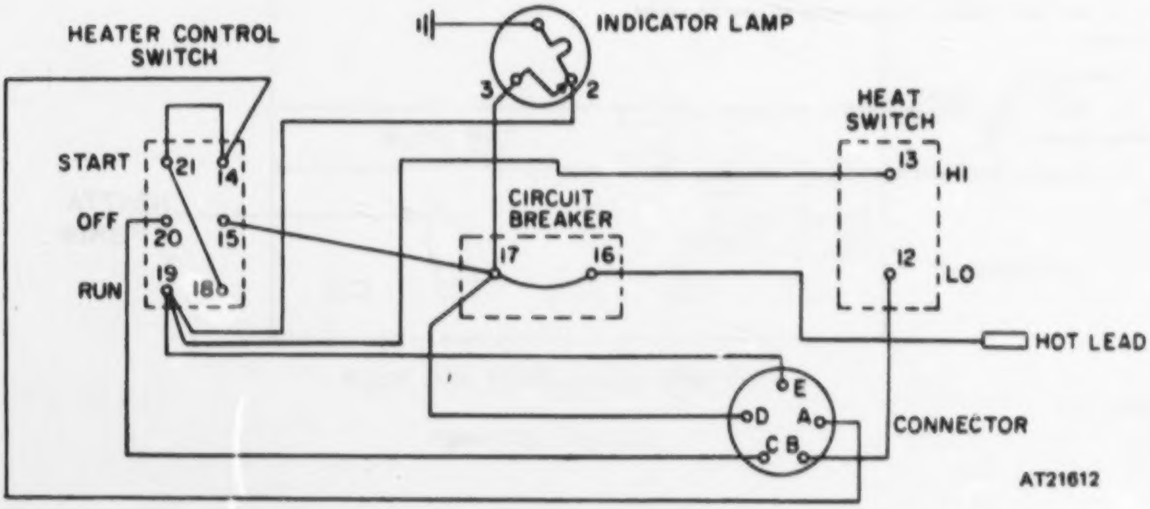


Figure 24-7. Control Box Wiring Diagram.

(2) If complete control box assembly is being replaced (para. *a(5)* above), remove two screws and slide out panel with attached parts from case.

(3) Place two screws with washers through case holes. Position one washer each on screw ends and position screws through mounting bracket holes of base plate. Install nut on screw end ON-OFF switch. On other screw position lockwasher, power harness terminal lug, heater harness terminal lug, and split lockwasher, and retain all with nut.

(4) With electrical components assembled as a unit, slide panel into case and secure with two screws.

(5) Connect electrical connector of power harness and connector of heater harness to control box assembly.

(6) Install guard and retain with three screws and nut.

(7) Connect 24 volt battery ground cable.

24-24. Radiator Grille Cover.

Refer to TM 10-269 for general repair instructions.

24-25. Engine Hood Cover.

Refer to TM 10-269 for general repair instructions.

24-26. Cargo Box Cover.

Refer to TM 10-269 for general repair instructions.

24-27. Cargo Box Bow.

a. Removal.

(1) Disconnect personnel heater duct by removing top clamp on duct.

(2) Remove cargo cover attaching hardware.

(3) Fold cargo cover from frame to expose bows.

(4) Replace defective components of bow assembly as required.

b. Installation.

(1) Place cargo cover in position and secure with attaching hardware.

(2) Connect personnel heater duct and secure with clamp.

CHAPTER 25
MATERIEL USED IN CONJUNCTION WITH MAJOR ITEM

25-1. Blackout Lighting Kit Installation.

a. Cab Harness.

(1) Disconnect batteries.

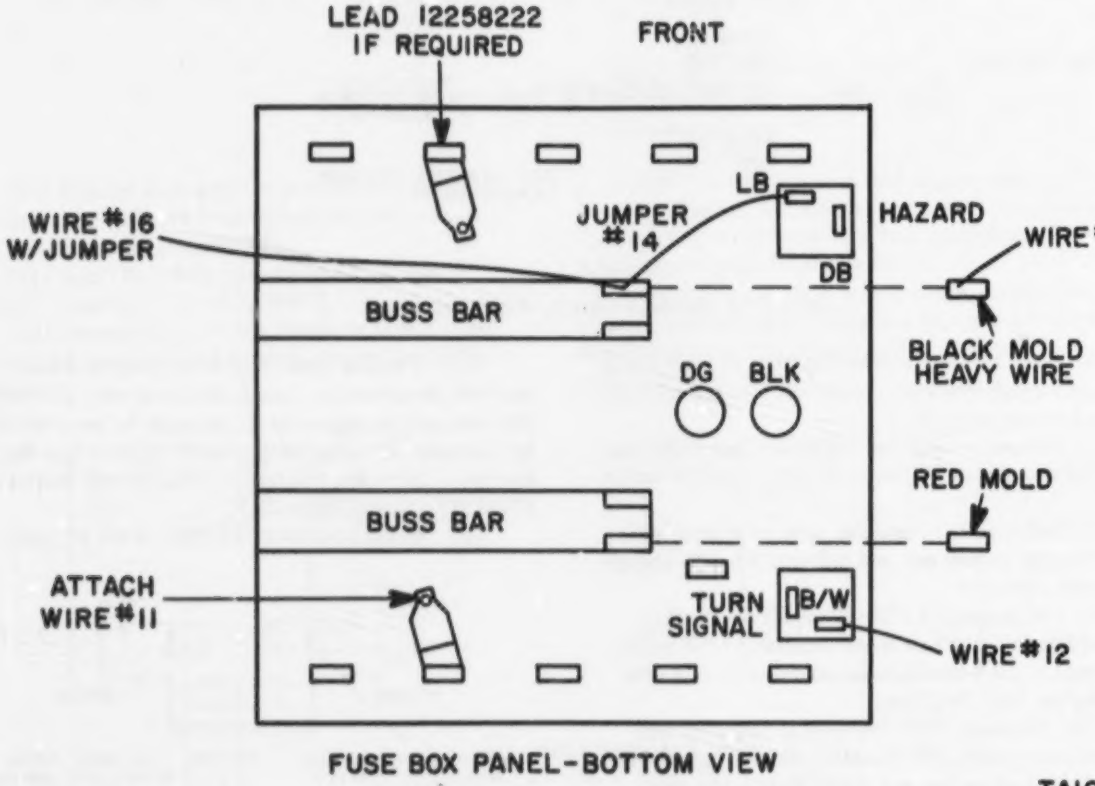
(2) Remove bottom of glove compartment.

(3) Remove fuse box cover.

(4) Remove two screws which retain fuse panel. For easy access turn fuse panel upside down (figure 25-1).

(5) Remove screws which retain instrument panel cover. Cover may be pulled out and rested on top of dashboard.

(6) Insert harness 12258215 through instrument panel opening, routing cable end with wires 5, 11, 12, 14, 16, and 17 to fuse box area. Route wires 2, 8, and 1 and 15 (which are together in housing 12258175) to stoplight


LEAD 12258222
IF REQUIRED
FRONT
LB
JUMPER
#14
HAZARD
WIRE #16
W/JUMPER
WIRE # 5
DB
BUSS BAR
BLACK MOLD
HEAVY WIRE
DG
BLK
RED MOLD
BUSS BAR
ATTACH
WIRE #11
TURN
SIGNAL
B/W
WIRE #12
FUSE BOX PANEL-BOTTOM VIEW

TAI06083

Figure 25-1. Fuse Panel.

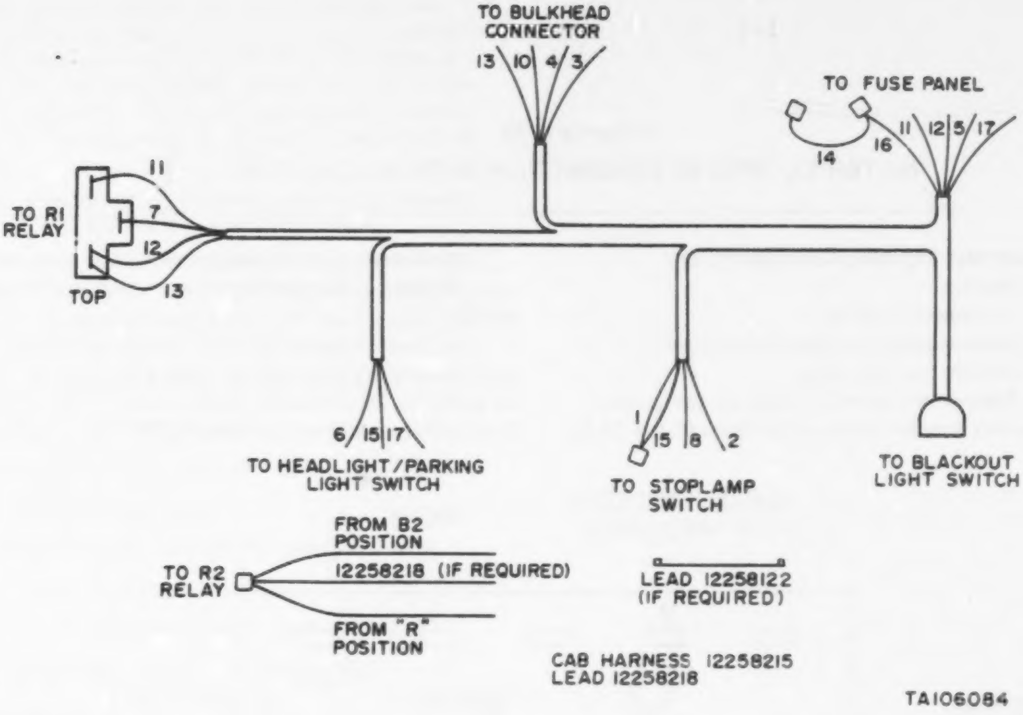

TO BULKHEAD CONNECTOR
13
10
4
3
TO FUSE PANEL
14
16
11
12
5
17
TO R1 RELAY
11
7
12
13
TOP
6
15
17
TO HEADLIGHT/PARKING LIGHT SWITCH
1
15
8
2
TO STOPLAMP SWITCH
TO BLACKOUT LIGHT SWITCH
FROM B2 POSITION
TO R2 RELAY
12258218 (IF REQUIRED)
FROM "R" POSITION
LEAD 12258122 (IF REQUIRED)
CAB HARNESS 12258215
LEAD 12258218
TA106084

Figure 25-2. Blackout Lighting Kit Cab Harness.

switch area, and then route remaining wires to the left side of vehicle through instrument panel following route of production harness (figure 25-2).

(7) Remove headlight switch by first depressing the knob and stem release button on the bottom of the switch housing.

(8) Pull knob to release and remove the knob and stem. Remove spanner nut, and pull switch out far enough to separate connector.

(9) Position relay 12258170 on bottom lip of dashboard so that first hole is approximately 1-5/8 inches to the right of the T-handle brake release and, using relay as a template, mark dashboard.

(10) Drill holes 3/16" diameter at both hole locations and secure relay with two MS35206-245 screws, two MS35335-31 lockwashers and two MS35649-282 nuts. Attach three-terminal connector 12258202, which retains wires 7, 11, 12, and 13, to relay which is designated as R1 relay.

NOTE

At this point it is necessary to determine if the vehicle has a parking light relay which is located directly to the right of the fuse box.

(11) If vehicle does not have the relay, as is the case with the ambulance, install additional relay 12258170. This relay will be designated R2 and must be mounted in the same manner as first relay, directly to the left of the first relay. In the kit, find lead, 12258218, with connector 12258202 attached (figure 25-3).

(12) Attach connector 12258202 to the R2 relay.

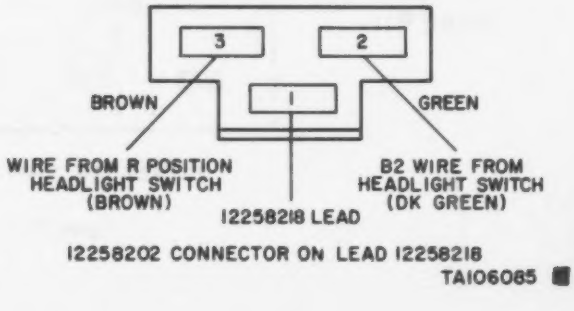

3
2
1
BROWN
GREEN
WIRE FROM R POSITION HEADLIGHT SWITCH (BROWN)
12258218 LEAD
B2 WIRE FROM HEADLIGHT SWITCH (DK GREEN)
12258202 CONNECTOR ON LEAD 12258218
TA106085

Figure 25-3. Connector on Lead 12258218.

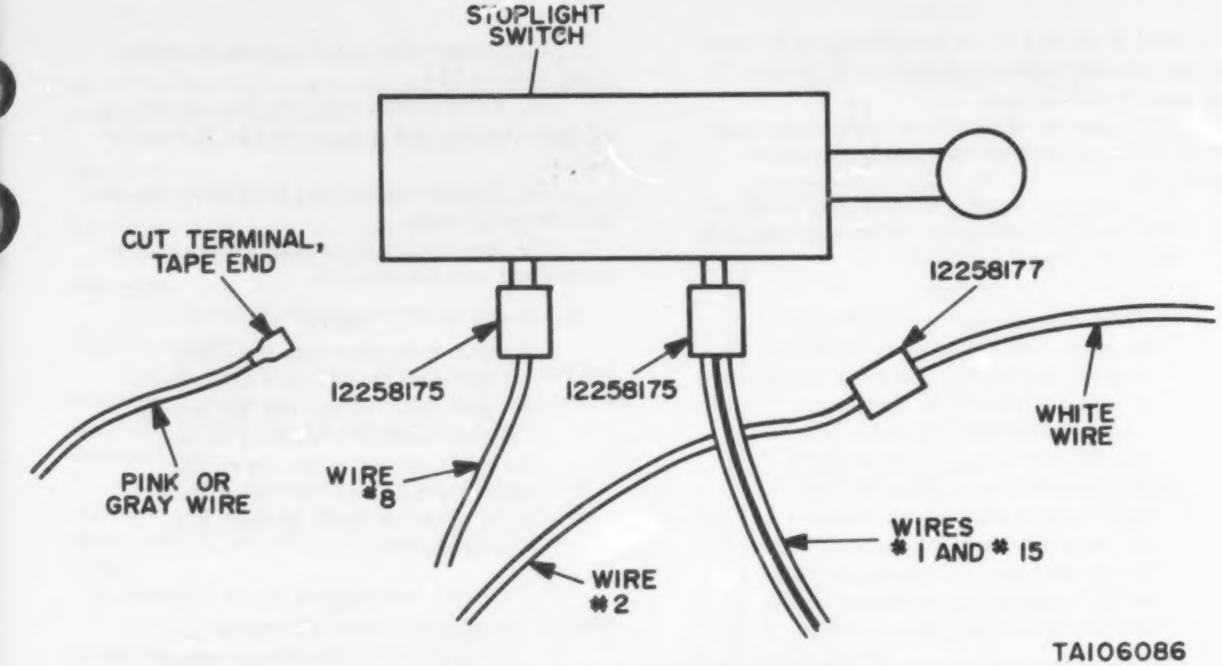

STOPLIGHT SWITCH
CUT TERMINAL, TAPE END
12258177
12258175
12258175
WHITE WIRE
PINK OR GRAY WIRE
WIRE #8
WIRES # 1 AND # 15
WIRE #2
TAI06086

Figure 25-4. Stoplight Switch Connection.

(13) Proceed to stoplight switch above brake pedal and remove the white wire and replace with wires 1 and 15 in 12258175 housing (figure 25-4).

(14) Insert the white wire, just removed, into the 12258177 housing which retains wire 2.

(15) Remove the pink wire (could be gray in some vehicles) and connect wire 8 which is retained in 12258175 housing.

(16) Cut terminal from pink or gray wire and tape wire end securely. Tie slack wire with MS3367-1-9 cable strap.

(17) Remove black wire from headlight/parking light switch contact B1 (figure 25-5).

(18) If the vehicle is an ambulance, connect the wire removed in step (17) from the B1 contact to the male terminal of wire 17 in harness 12258215 (figure 25-2) and tape connection securely.

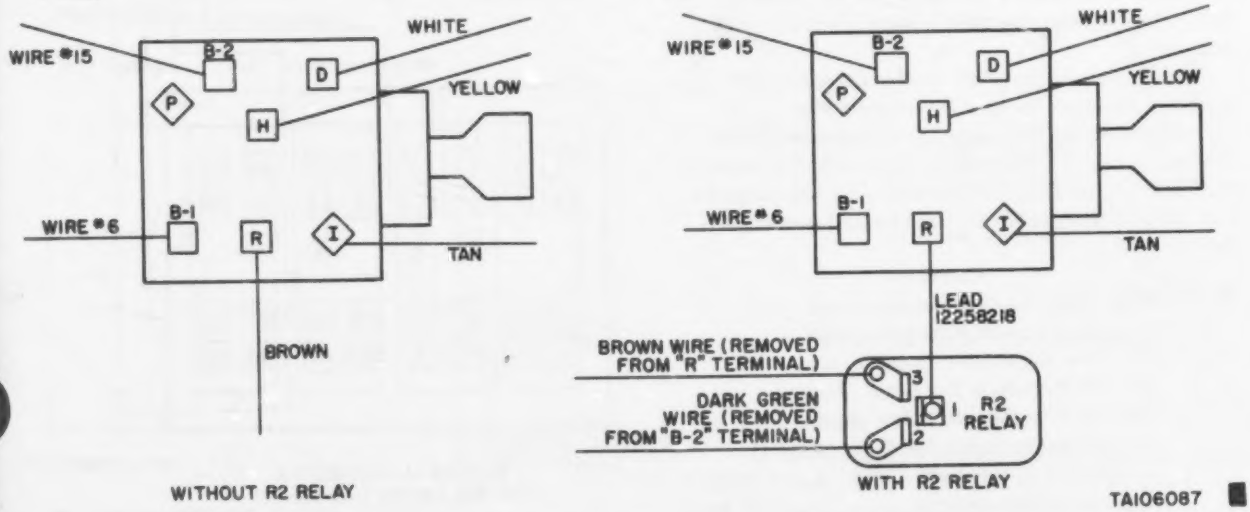

WIRE #15
B-2
WHITE
D
YELLOW
P
H
WIRE #6
B-1
R
I
TAN
BROWN
WITHOUT R2 RELAY
WIRE #15
B-2
WHITE
D
YELLOW
P
H
WIRE # 6
B-1
R
I
TAN
LEAD 12258218
BROWN WIRE (REMOVED FROM "R" TERMINAL)
DARK GREEN WIRE (REMOVED FROM "B-2" TERMINAL)
3
1
2
R2 RELAY
WITH R2 RELAY
TAI06087

Figure 25-5. Vehicle Headlight/Parking Light Switch.

(19) If vehicle is not an ambulance, snip the terminal from the wire removed from contact B1 in step (17) and tape wire end securely.

(20) Insert the terminal from harness wire 6 onto the B1 contact of the headlight/parking light switch (figure 25-5).

(21) Remove the dark green wire from the B2 contact of the headlight/parking light switch and install in its place wire 15 of harness 12258215.

NOTE

If relay R2 was required and installed in step (11), the green wire removed from headlight/parking light switch contact B2 must be connected to the 2 position of connector 12258202 (figure 25-3) on relay R2. The brown wire from the "R" position of the headlight/parking light switch must be removed and inserted into the 3 position of connector 12258202. Two or three inches of the commercial harness wrapping may be stripped back as necessary to facilitate the connection.

(22) Insert the terminal from lead 12258218 (figure 25-5) onto the "R" contact of the headlight/parking light search.

NOTE

If relay R2 was not required, the terminal of the dark green wire removed from the B2 position contact of the headlight/parking light switch should be cut off and the end of the wire taped securely. If wire 17 of harness 12258215 was not utilized, tape the exposed terminal securely.

(23) Reinstall headlight/parking light switch by performing the steps described in steps (7) and (8) in reverse order.

(24) Remove the black, molded connector with the heavy wire from the vehicle fuse panel buss.

(25) Connect this connector disconnected in step (24) to housing 12258177 which retains wire 5 of harness 12258215 (figure 25-2). Attach wire 16 of harness to the buss terminal from which the black molded connector was removed.

NOTE

If the vehicle is an ambulance, it will be necessary to trace the power lead wire from the added ambulance fuse panel to the vehicle fuse panel. Remove the wire from the vehicle fuse panel and connect its terminal with the terminal of wire 17 in harness 12258215. Tape connection securely.

(26) Remove the light blue (LB) wire from the hazard warning terminal (figure 25-1) and connect in its place wire 14 of harness. Remove terminal from light blue wire and tape wire end securely.

(27) Connect wire 11 to fuse panel terminal as shown in figure 25-1.

(28) Remove black/white wire from the turn signal flasher terminal and replace with wire 12 from the harness.

(29) Remove terminal from black/white wire and tape wire end securely.

(30) Securely tape the terminal of wire 17 if not required and leave disconnected.

NOTE

If vehicle is equipped with a spotlight, the light must be inoperative during blackout conditions. To wire this light into the blackout system, it is necessary to trace the light's connection into the existing wiring and disconnect the light at that point. If vehicle has no spotlight, proceed to step (33).

(31) Connect male terminal of lead 12258222 to spotlight wire and tape connection securely.

(32) Route spotlight lead along existing cab harness to vehicle fuse panel and connect female lead to terminal as shown in figure 25-1.

(33) Reinstall fuse panel.

(34) Separate bulkhead connector (located under the hood at extreme left of firewall).

(35) Depress locking tang of receptacle 14 by inserting a thin, narrow tool into groove of plastic connector of bulkhead connector receptacle (figure 25-6).

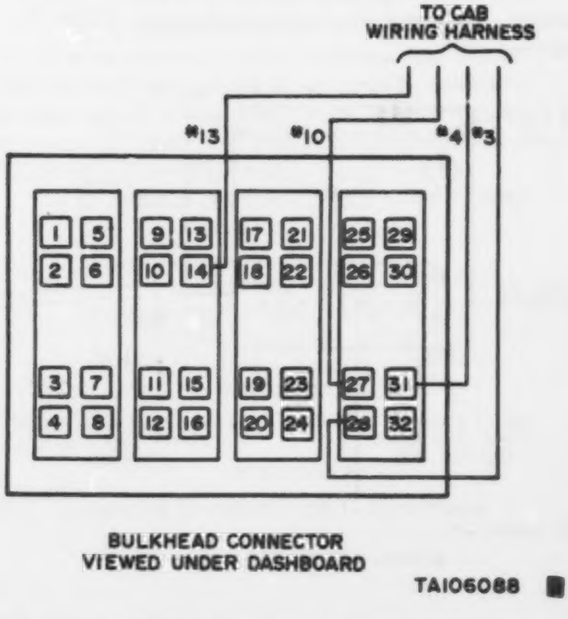


Figure 25-6. Bulkhead Connector.

(36) Remove green/black wire from receptacle 14, cut off the terminal, and tape wire end securely (accessible from underside of dashboard).

(37) Insert terminal end of harness wire 13 into receptacle 14.

(38) Insert harness wire 4 into receptacle 31, wire 10 into receptacle 27, and wire 3 into receptacle 28.

(39) Tie slack wires together with MS3367-1-9 cable strap.

(40) Electrically disconnect voltage indicator, if vehicle is so equipped.

(41) Remove instrument panel from dashboard and at extreme right side of the instrument panel using template 12258220, provide one oval hole and four 1/4-inch diameter holes.

(42) Mount blackout light switch in the oval hole, so its three control levers can be easily operated by the vehicle operator, and secure with four MS35191-274 screws.

NOTE

> Lamp removal may be accomplished by reaching behind instruments, locating lamps with the fingers, twisting slightly and removing.

(43) Remove three 158 instrument lamps (located behind instruments) and two 1892 lamps in heater control area. Install the five red rubber filters, 12258219, over the three 158 instrument lamps and the two 1892 lamps in the heater control area and reinstall lamps (figure 25-7).

(44) Connect cab wiring harness to blackout lighting switch by attaching harness connector to switch.

(45) Reconnect voltage indicator (if necessary), and reinstall instrument panel and glove compartment. This completes cab installation.

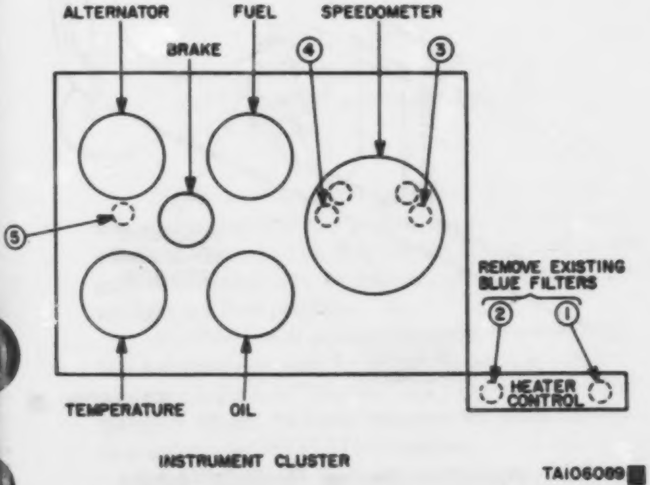

ALTERNATOR
FUEL
SPEEDOMETER
BRAKE
④
③
⑤
REMOVE EXISTING BLUE FILTERS
②
①
HEATER CONTROL
TEMPERATURE
OIL
INSTRUMENT CLUSTER
TA106089

Figure 25-7. Instrument Cluster Lamp Filter Locations.

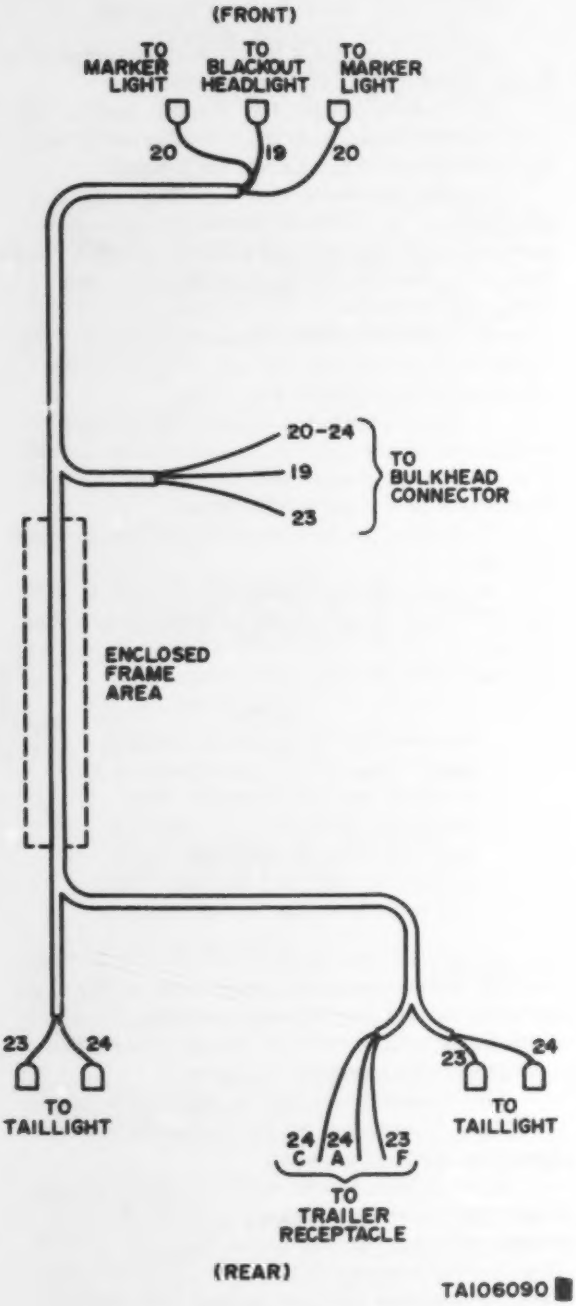

(FRONT)
TO MARKER LIGHT
TO BLACKOUT HEADLIGHT
TO MARKER LIGHT
20
19
20
20-24
19
23
TO BULKHEAD CONNECTOR
ENCLOSED FRAME AREA
23
24
TO TAILLIGHT
24 C
24 A
23 F
TO TRAILER RECEPTACLE
23
24
TO TAILLIGHT
(REAR)
TA106090

Figure 25-8. Main Wiring Harness.

b. Main Harness.

(1) Route rearward portion of main harness 12258214 downward to the left side of steering column under the hood, retaining forward (shorter) end of harness in close proximity to bulkhead connector (figure 25-8).

(2) From underneath vehicle, position harness so that it will follow the path of existing harness.

(3) From the rear left side of vehicle, route a "fish tape" forward through main frame member until it exits forward in the area where harness was dropped.

(4) After securing harness to fish tape and taping connectors around main cable for ease in routing cable rearward, pull harness rearward until it is accessible. Route harness along existing harness utilizing existing cable clamps where available.

(5) Use self-clinching cable ties MS3367-1-9, to tie harness to existing harness near both taillight locations and in the area of the trailer connection.

(6) Remove the four bolts and nuts which retain the trailer receptacle and drop connector to an accessible location. Remove grommet nut, slide grommet up wires far enough to solder new wires into pins.

(7) Remove the three grommet rods from positions A, C, and F.

(8) Insert the three corresponding wires 24A, 24C, and 23F of the new harness through grommet and solder into pins A, C, and F respectively. Replace grommet and grommet nut and remount trailer receptacle.

NOTE

Harness should be inserted into existing cable clamps on top of inner fender and in radiator area where possible. New harness should be tied to existing harness at front left and right corners using MS3367-1-9 cable ties. Harness should also be tied at the left side of battery.

(9) In the forward area of vehicle, under the hood, route the harness around the outside of the battery to the top of the radiator area following existing harness underneath the top radiator mounting bracket and directing connectors to the appropriate locations.

(10) Connect plastic housing which retains wires 27, 28, and 31 into lower left open section of bulkhead connector. Resecure connector.

(11) On those vehicles which do not have a trailer receptacle, remove approximately 16 of the 19 inches of the harness section containing wires 24A, 24C, and 23F. Strip back the wrapping on the remaining section of the harness so the three wires may be taped individually and then taped together securely to prevent any exposure of bare wires.

c. Lamp Installation.

CAUTION

Add paint to exposed bare metal surfaces.

(1) Remove 13 screws from top and bottom of grille, disconnecting parking light sockets when necessary, and lift grille from vehicle.

NOTE

On the 1976 model the headlight cowlings must be removed and also two screws at each end of grille.

(2) Hold mounting bracket 12258216 and blackout headlight 12258221 on the left side of the radiator core support on the four-inch wide, vertical surface which has the three horizontal stiffener ribs (figure 25-9). Position the bracket so that the bottom edge of the mounting side surface rests along the top of the second rib from the bottom, with the forward bolt hole located in the center of the double thickness area of the core support.

(3) Mark holes so measurement from the top of the bracket to the bottom horizontal member of the radiator core support is 7-1/4 inches.

(4) Drill two holes 9/32 inches in diameter and install bracket using two MS90728-6 bolts, two MS35335-33 lockwashers, and two MS35649-2252 hex nuts.

(5) Mount head light in a level position on the bracket, using hardware already installed on headlight stud, connect wire 19 of harness to blackout headlight.

(6) Replace parking lights if necessary and position grille (do not re-fasten) on the vehicle to determine section of grille to be cut out and remove the section of the grille that would interfere with function of headlight.

(7) Front marker lights, 12258211, are mounted directly above the vehicle headlights and centered on the vertical centerline of the headlights.

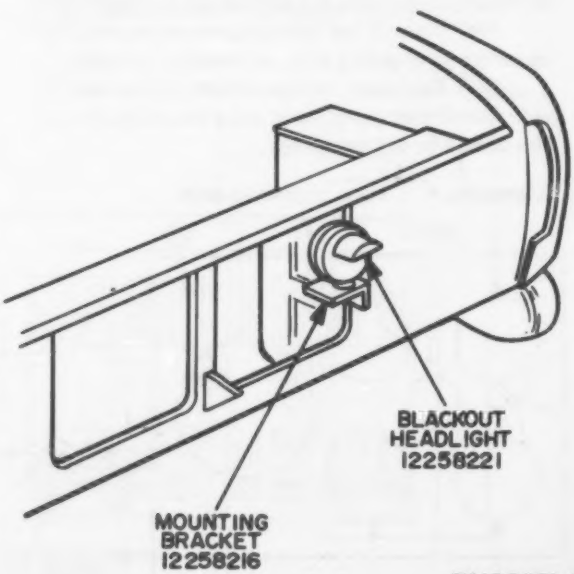


Figure 25-9. Blackout Headlight Mounting.

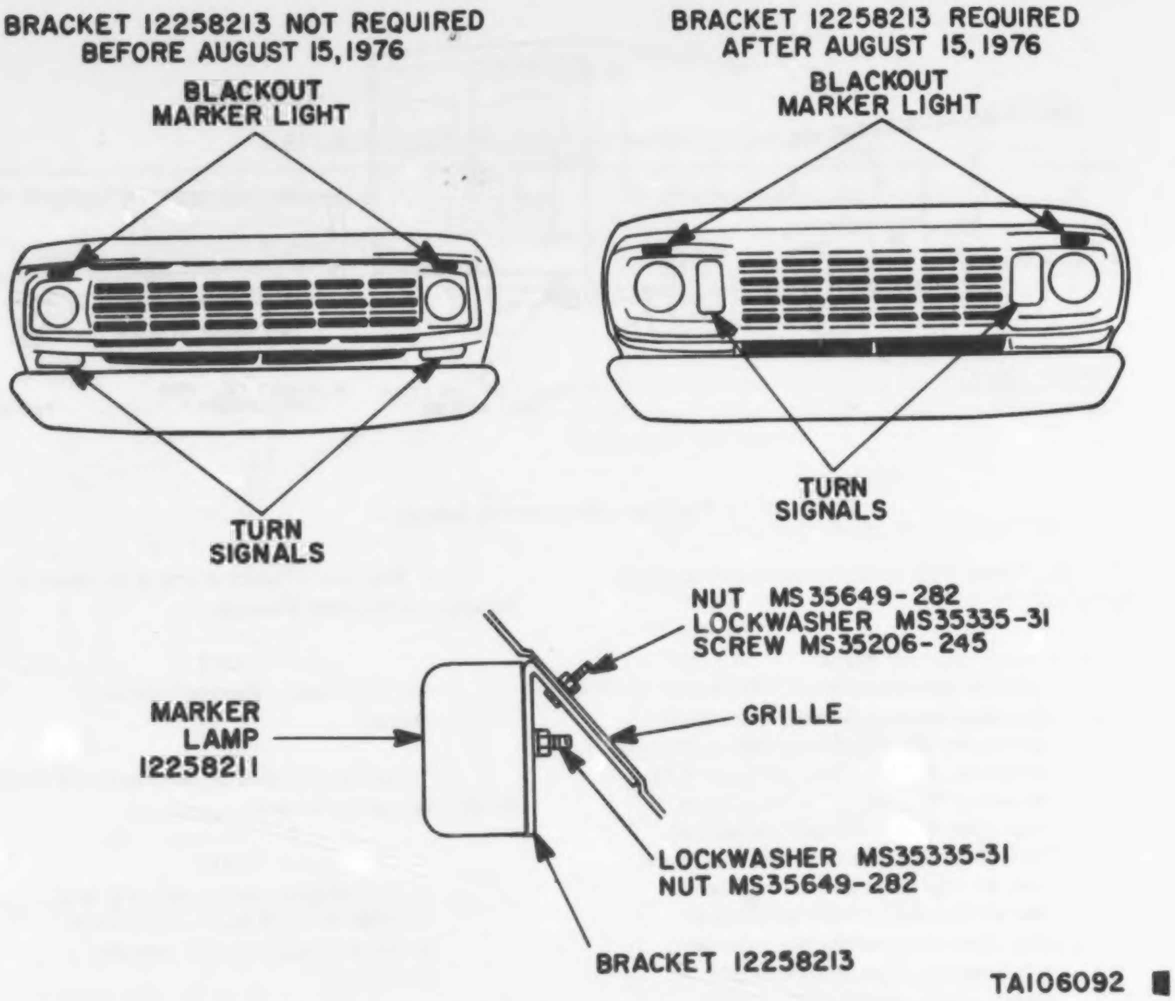

BRACKET 12258213 NOT REQUIRED
BEFORE AUGUST 15, 1976
BLACKOUT
MARKER LIGHT
TURN
SIGNALS
BRACKET 12258213 REQUIRED
AFTER AUGUST 15, 1976
BLACKOUT
MARKER LIGHT
TURN
SIGNALS
NUT MS35649-282
LOCKWASHER MS35335-31
SCREW MS35206-245
MARKER
LAMP
12258211
GRILLE
LOCKWASHER MS35335-31
NUT MS35649-282
BRACKET 12258213
TA106092

Figure 25-10. Blackout Marker Lights.

NOTE

A design difference between the 1976 and 1977 model grilles necessitates different installation.

(8) On a 1976 model, the marker lights will be mounted in the horizontal indentation directly above the headlight (figure 25-10). Position the marker light on the grille as indicated so that hole locations can be marked with the light in a level position.

(9) Find center point between the two mounting hole locations and mark for the connector hole. Drill mounting holes 3/16" diameter and connector holes 3/4" diameter. Mount the lights using two MS35649-282 hex nuts and two MS35335-31 lockwashers.

(10) Mount the front marker lights on a 1977 model with mounting brackets 12258213. Position bracket 12258213 in the same location as described above but on the one-inch wide, angled, flat and recessed surface of the grille directly above the headlight.

(11) Using bracket as a template, mark mounting holes (make sure holes used for marking are not the light mounting holes).

(12) The hole for the connector is centered between the mounting holes. Drill grille mounting holes 3/16" diameter and the connector clearance hole 3/4" diameter.

(13) Fasten marker light to bracket using two MS5649-282 hex nuts and two MS35335-31 lockwashers and then mount assembly to the grille using two MS35206-254 screws, two MS35335-31 lockwashers and two MS35649-282 hex nuts.

(14) Reposition grille on the vehicle, and connect the light connectors to the main harness connectors (the long 20 wire is connected to the right front marker light with the shorter wire connected to the left front marker light).

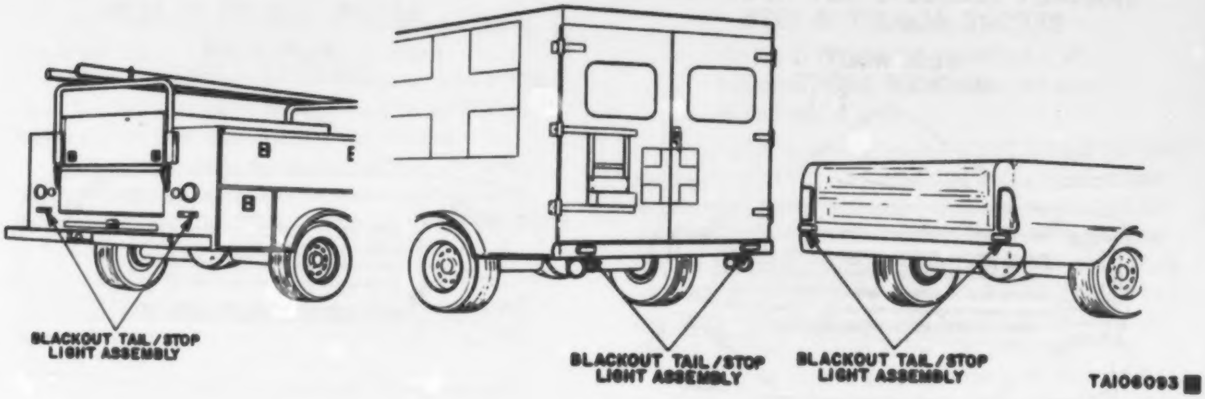

BLACKOUT TAIL/STOP LIGHT ASSEMBLY
BLACKOUT TAIL/STOP LIGHT ASSEMBLY
BLACKOUT TAIL/STOP LIGHT ASSEMBLY
TA106093

Figure 25-11. Tail/Stop Light Assembly Locations

(15) Fasten grille by reinstalling screws removed in step (1).

NOTE

Tail/stop light assemblies 12258212 are mounted directly underneath existing taillights on the M880/890 cargo trucks (figure 25-11). Mounting holes are located by measuring 7/8" down from the external bend radius directly beneath the taillight. This will establish the horizontal line. Then from the edge of fender next to tailgate, measure outward one inch and three inches. This will locate the two mounting hole locations. Now measure in from the center of each mounting hole 11/16". This will locate the holes required for the light connectors.

Tail/stop light assemblies for the telephone maintenance truck will be mounted on the back panel at a location centered between the top of the rear bumper and the bottom of the existing taillights and centered horizontally on the width of the back panel. Connection of lamp wires to main harness is made inside the bottom rear utility compartment.

Tail/stop light assemblies for the ambulance will be mounted directly above the existing taillights on the bottom steel cross member spanning the width of the vehicle. Lights should be centered in line with the existing lights.

(16) Drill two 3/16-inch diameter mounting holes for each tail/stop light assembly.

NOTE

The two 3/4-inch diameter holes will overlap.

(17) Drill two 3/4-inch diameter holes per taillight for light connector clearance.

NOTE

Vehicle taillights must be removed from M880/M890 cargo truck to gain access for blackout tail/stop light assembly installation.

(18) Insert tail/stop light assembly mounting studs and connectors through holes drilled in steps (16) and (17).

(19) Fasten tail/stop light assemblies to fender sheet metal with two MS35649-282 hex nuts and two MS35335-31 lockwashers.

(20) Connect connectors of tail/stop light assemblies to main wiring harness connectors (figure 25-8).

(21) Reinstall vehicle taillights.

(22) Actuate all vehicle lighting controls and blackout lighting kit lighting controls to make sure installation functions properly.

(23) Touch up screw heads and other exposed bare metal with recommended paint.

CHAPTER 26

REPLACEMENT OF THE RADIATOR CORE SUPPORT

26-1. Replace Radiator Core Support.

The radiator core support is attached with "U" nuts, screws, and nuts. The splash shield is mounted with screws on the inner side of the sheet metal.

a. Removal. Refer to figure 26-1.

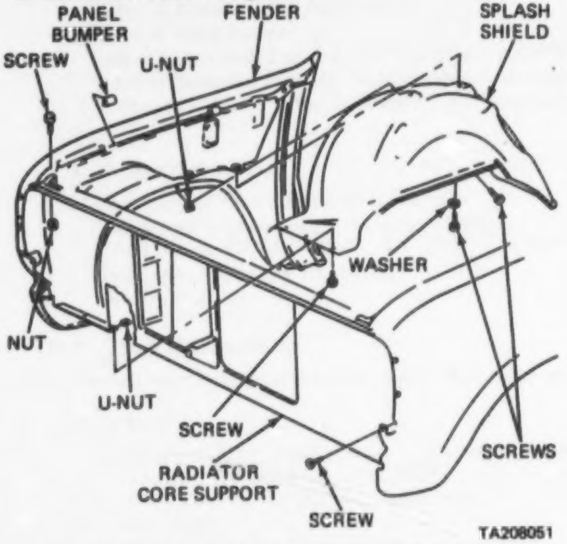


Figure 26-1. Radiator Core Support and Splash Shield.

(1) Raise the hood and remove the battery.

(2) Drain and remove the radiator.

(3) Remove both headlight cowlings.

(4) Remove the grille and both headlights.

(5) Disconnect the battery tray from the radiator-grille support panel. Refer to TM 9-2320-266-20.

(6) Remove the horn.

(7) Remove the screws attaching the right fender to the right wheelhouse. Then swing the right fender panel out, pivoting it at the cowl, far enough to disengage it from the radiator core support.

CAUTION

Be careful not to damage the fender or cowl panel.

(8) Remove the radiator core support panel.

b. Installation.

(1) Install six "U" nuts on the lower flange of the radiator core support. Install the support.

(2) Secure the right fender to the wheelhouse and the radiator core support. Tighten the screws.

(3) Install the horn.

(4) Install and refill the radiator.

(5) Attach the battery tray to the radiator core support.

(6) Install and aim the headlights (paragraph 2-50).

(7) Install the grille and both headlight cowlings.

(8) Install and reconnect the battery.

APPENDIX A

REFERENCES

A-1. Publication Indexes and General References.

Indexes should be consulted frequently for latest changes or revisions of references given in this appendix and for new publications relating to material covered in this publication.

a. Military Publication Indexes.

Index of Administrative Publications	DA Pam 310-1
Index of Blank Forms	DA Pam 310-2
Index of Doctrinal, Training, and Organizational Publications	DA Pam 310-3
Index of Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8, and 9) Supply Bulletins, and Lubrication Orders	DA Pam 310-4

b. General References.

Dictionary of United States Army Terms	AR 310-25
Authorized Abbreviations and Brevity Codes	AR 310-50
Training Management in Battalions	TC 21-5-7
Techniques of Military Instruction	FM 21-6
Military Symbols	FM 21-30

A-2. Other Publications.

The following publications contain information pertinent to the major item materiel and associated equipment.

a. Vehicle.

Lubrication Order, Truck, Cargo, 1-1/4 Ton, 4X4, M880; Truck, Cargo, 1-1/4 Ton, 4X2, M890; Truck, Ambulance 1-1/4 Ton, 4X4, M886; Truck, Ambulance, 1-1/4 Ton 4X2, M893	LO 9-2320-266-12
Operator's Manual	TM 9-2320-266-10
Organizational Maintenance	TM 9-2320-266-20
Organizational Maintenance Repair Parts and Special Tools List	TM 9-2320-266-20P
Direct and General Support Repair Parts and Special Tools List	TM 9-2320-266-34P
Warranty	TB 9-2300-266-15/14

b. Camouflage.

Camouflage	FM 5-20

c. Decontamination.

Chemical, Biological, and Radiological (CBR) Decontamination	TM 3-220
Chemical, Biological, Radiological, and Nuclear Defense	FM 21-40

d. General.

Accident Reporting and Records	AR 385-40
Basic Cold Weather Manual	FM 31-70
Cooling Systems: Tactical Vehicles	TM 750-254
Manual for Wheeled Vehicle Driver	FM 21-305
Driver Selection and Training (Wheeled Vehicles)	TM 21-300
Mountain Operations (How To Fight)	FM 90-6
Northern Operations	FM 31-71
Operation and Maintenance of Ordnance Materiel in Cold Weather ($0^{o}F$ to $-65^{o}F$)	FM 9-207

Principles of Automotive Vehicles------------------------------------TM 9-8000
Prevention of Motor Vehicle Accidents--------------------------------AR 385-55
Procedures for Destruction of Equipment to Prevent Enemy Use----- TM 750-244-6

e Maintenance and Repair

Cleaning of Ordnance Materiel--TM 9-208-1
Description, Use, Bonding Techniques, and Properties of Adhesives----TB ORD 1032
Inspection, Care and Maintenance of Antifriction Bearings------------TM 9-214
Materials Used for Cleaning, Preserving, Abrading, and Cementing Ordnance Materiel and Related Materiels Including Chemicals--------TM 9-247
Metal Body Repair and Related Operations-----------------------------FM 43-2
Color, Marking and Camouflage Painting of Military Vehicles, Construction Equipment, and Materials Handling--------------------TB 43-0209
Operation and Organizational, Field and Depot Maintenance: Storage Batteries, Lead-Acid Type-------------------------- TM 9-6140-200-14
Painting Instructions for Field Use----------------------------------TM 43-0139
Use of Antifreeze Solutions and Cleaning Compounds in Engine Cooling Systems---TB 750-651
Welding Theory and Application---------------------------------------TM 9-237

f Shipment and Limited Storage

Administrative Storage of Equipment----------------------------------TM 740-90-1
Preservation, Packaging, and Packing of Military Supplies and Equipment: Preservation and Packaging Volume I----------------TM 38-230-1
Preservation, Packaging, and Packing of Military Supplies and Equipment: Packing Volume II----------------------------------TM 38-230-2
Preservation, Packaging and Packing Materials, Supplies and Equipment Used by the Army-------------------------------------SB 38-100
The Army Maintenance Management Systems(TAMMS)-----------------------TM 38-750

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By Order of the Secretary of the Army:

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Chief of Staff

Official:
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Major General, United States Army
The Adjutant General

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FT. LEONARD WOOD MO 63108

DATE 16 DEC 74

PUBLICATION NUMBER TM5-6115-200-20 AND P

DATE 1 APR 72

TITLE GENERATOR SET 10 KW NSN 6115-00-231-7286

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PAGE NO.	PARAGRAPH	FIGURE NO.	TABLE NO.	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
6	2-1 a			In line 6 of paragraph 2-1a the manual states the engine has 6 cylinders. The engine on my set only has 4 cylinders. Change the manual to show 4 cylinders
81		4-3		Callout 16 on figure 4-3 is pointing at a bolt. In the key to fig. 4-3, item 16 is called a shim. Please correct one or the other.
125	line 20			I ordered a gasket, item 19 on figure B-16 by NSN 2910-00-762-3001. I got a gasket but it doesn't fit. Supply says I got what I ordered so the NSN is wrong. Please give me a good NSN

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